

Edited at the
Massachusetts Institute of Technology
April, 1970. Price, \$1.25

A special issue devoted to the achievements,
frustrations, and potentials in spanning the
continent which separates technology and medicine



Technology Review

Articles by G. Octo Barnett,
Ivan L. Bennett, Robert H. Ebert,
Rashi Fein, Samuel Moffatt,
Hamish N. Munro,
William M. Siebert,
and Alonzo S. Yerby

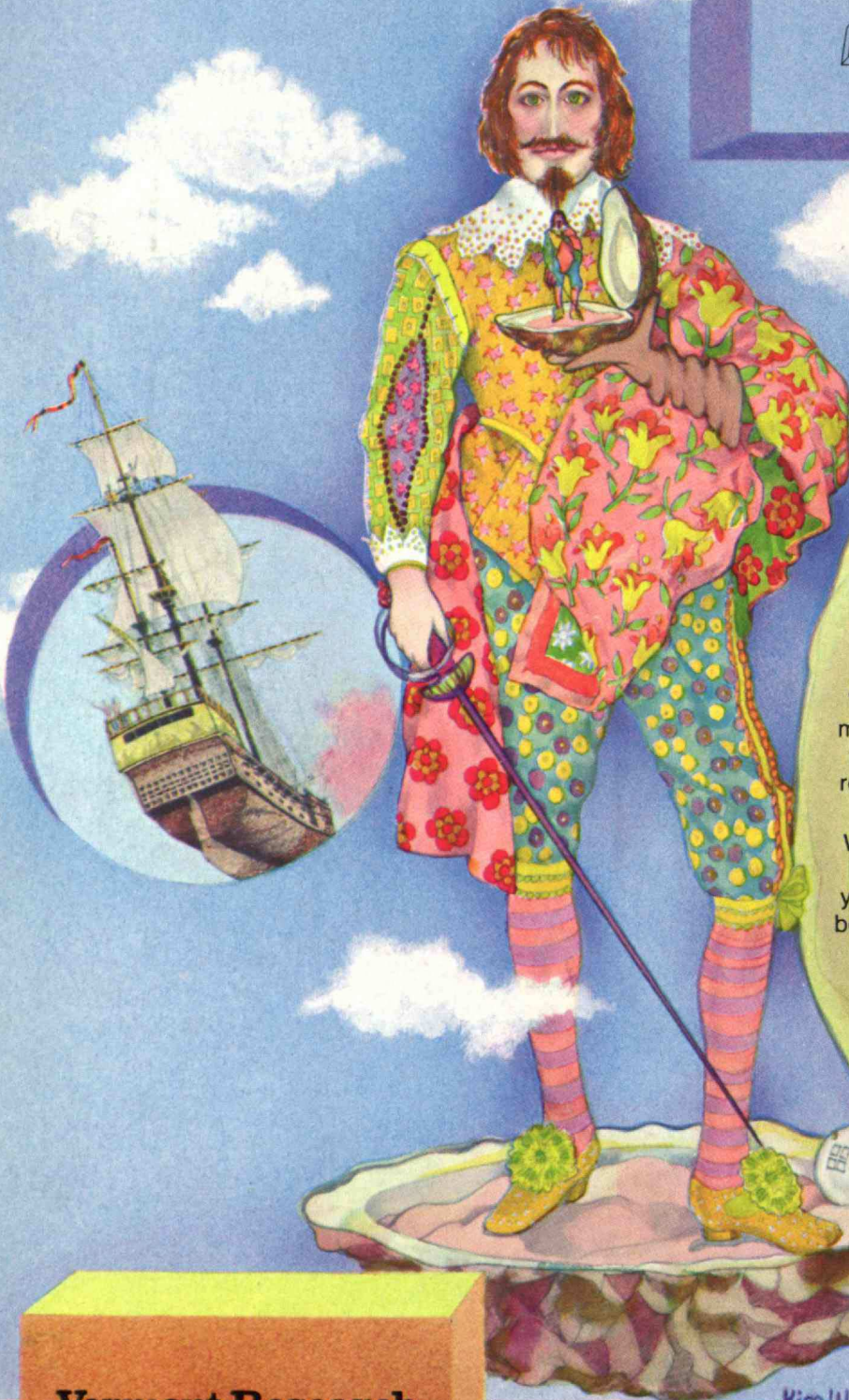


technology review

Published by MIT

This PDF is for your personal, non-commercial use only.
Distribution and use of this material are governed by copyright law.
For non-personal use, or to order multiple copies please email
permissions@technologyreview.com.

**WHO SAID:
"HE WAS A BRAVE MAN
WHO FIRST
ATE AN OYSTER"**



Jonathan Swift wrote it, simplifying King James I's saying: "He was very valiant that first adventured on eating oysters."

We don't want to blow your mind with trivia. We just want to expand it slightly. With a reminder: Vermont Research is the memory company.

We're the company that can expand the capabilities of your computer. We make the best drum and disk memories that are made anywhere.

When you want to expand your computer's memory, talk to us. We're simple North Country folk, and we'd love to talk.

Kim Whitesides

**Vermont Research
CORPORATION**

Precision Park, North Springfield, Vermont 05150
Tel. (802) 886-2256, TWX 710-363-6533

DRUM AND DISK MEMORIES - CONTROLLERS

EXPAND YOUR MEMORY

See us at booth #30,000 at SJCC

**Pecuniam ad ferias
Romanas reservate.**

Cambridge Trust Company

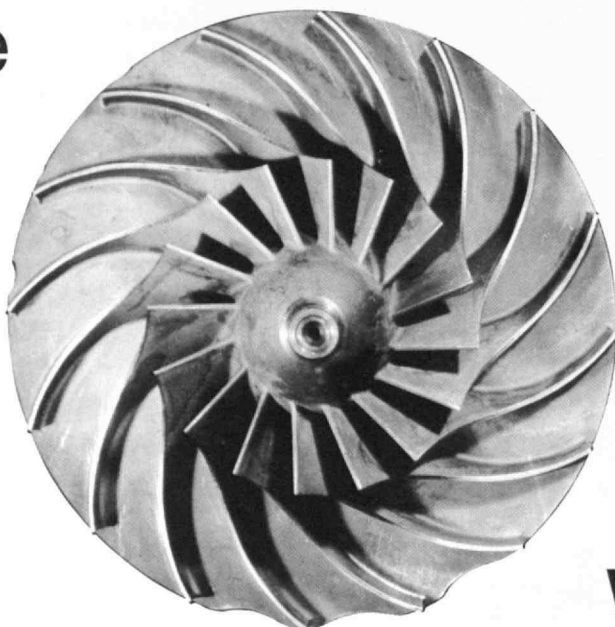
876-5500



Harvard et Kendall Squares

Member F.D.I.C.

The



Wheel

Superior Air Handling Devices . . .

Substantial contributions to centrifugal compressor development are currently being made by our technical staff through a major three-year technology program. A new experimental facility which incorporates the latest in instrumentation and data reduction equipment is currently producing valuable data for centrifugal compressor design and development.

This program is just one representation of NREC's efforts to advance gas turbine system and component technology. Sponsorship in the "Engineering Research Program for Centrifugal Compressors" is now open to

industry. Centrifugal fluid machines have found application in a variety of products such as aircraft and industrial gas turbines, chemical process turbomachinery, commercial air conditioning and refrigeration systems, and aircraft and space vehicle thermal control systems.

If you would like to know more about our engineering research program for centrifugal compressors and the terms for its sponsorship, you are invited to write to the Marketing Department, Northern Research and Engineering Corporation, 219 Vassar Street, Cambridge, Massachusetts 02139, or call 617 491-2770.

Northern Research & Engineering CORPORATION

PRINCIPAL OFFICES are located in Cambridge, Massachusetts and London, England.

SALES REPRESENTATION in Dayton, Ohio; Encino, California; Grenoble, France; and Washington, D. C.



Are startling things
about to happen in
computer
technology at
RCA MARLBORO?

Computer equipment is now in great demand. Yet, it's really just starting its evolution.

Many fields call for its services. But before a sweeping new range of applications can be achieved, some lively creative engineering must come into play.

That's what RCA Marlboro is all about. A facility aimed at radically improving existing computer equipment, while moving right along into unexplored areas.

SPECIFIC OPENINGS

SR. ENGINEER CIRCUIT DESIGN

Responsible for development and design of high speed integrated circuit family. Emitter—Coupled—logic knowledge is desired.

TEST EQUIPMENT DESIGNER

Responsible for the design & fabrication of a semi-automatic "plug-in"

tester. Should have experience in logic, circuit design & test equipment.

INTERNAL MEMORY DESIGNER

Responsible for circuit & systems development of I/C memories. Definition of memory organization, fabrication, test and release for production.

SR. LOGIC DESIGNERS

Responsible for logic design on CPU or IOP. Will be given responsibility for activities from "pure" logic design through to prototype system checkout & release. Experience in microprogramming would also be desirable.

DESIGN AUTOMATION

Will participate in the design of logic simulation systems for use by computer logic designers for exercising machine level (EO) or gate level designs. Should have experience in third generation assembly language programming.

DATA MANAGEMENT SYSTEMS

Will participate in design of Data Management Systems. Will be involved in the support of Design & Maintenance using assembly language programming in a disc oriented system.

To arrange an interview, call Mr. D. J. McPhee at (617) 481-1500. Or send a resume to him at RCA Information Systems Division, 200 Forest Ave., Marlboro, Massachusetts 01752. We are an equal opportunity employer.

RCA
COMPUTERS



Technology Review, Reg. U.S. Patent Office, is published nine times each year (in October/November, monthly from December through June, and in July/August) at the Massachusetts Institute of Technology.

Copyright 1970 by the Alumni Association of the Massachusetts Institute of Technology.

Inquiries regarding editorial contents, subscriptions, and advertising should be addressed to: Technology Review, Room E19-430, Massachusetts Institute of Technology, Cambridge, Mass., 02139. Telephone area code (617) 864-6900, ext. 4872.

Technology Review is printed by the Lew A. Cummings Company, Manchester, New Hampshire. Second class postage paid at Manchester, New Hampshire.

Price: \$1.25 per copy, \$9 per year in the United States, \$10 in Canada and foreign countries. Please allow three weeks for changes of address, and give both old and new addresses in all requests.

Technology Review is represented for advertising by: Good, Laidley and White, 50 East 42nd Street, New York, N.Y., 10017, telephone (212) 986-6210; MediaRep Center, Inc., 1127 Statler Office Building, Boston, Mass., 02116, telephone (617) 542-7720; and Whaley-Simpson Co., Inc., 6725 Sunset Boulevard, Los Angeles, Calif., 90028, telephone (213) 463-7157, and 580 Washington Street, San Francisco, Calif., 94111, telephone (415) 781-4583.

Staff

Donald P. Severance, Publisher
John I. Mattill, Editor
Fred Wheeler, Managing Editor
Richard F. Wright, Advertising Manager
Ruth King, Associate Editor Emerita
Deborah Shapley, Associate Editor
Janet Kreiling, Associate Editor
Brenda Kelley, Associate Editor
Anne McCammon, Production Manager
John S. Pfeil, Jr., Business Manager
Dorothy R. Finnerty, Circulation Assistant

Editorial Advisory Board

Robert A. Alberty, Dean of the School of Science, M.I.T.
George A. W. Boehm, Science Writer
Carroll G. Bowen, President of Franklin Book Programs, Inc.
Gordon S. Brown, Dugald C. Jackson
Professor of Engineering, M.I.T.
Victor Cohn, Science Editor of the *Washington Post*
Robert C. Cowen, Science Editor of *The Christian Science Monitor*
David E. Gushee, Publication Manager—Journals, American Chemical Society
Leonard F. Newton, Vice President of Opinion Research Corporation
Walter A. Rosenblith, Associate Provost and Professor of Communications Biophysics, M.I.T.
Irwin W. Sizer, Dean of the Graduate School, M.I.T.
Eugene B. Skolnikoff, Professor of Political Science, M.I.T.
Gregory Smith, President of Eastman Gelatine Corporation, *Chairman*
Arthur J. Snider, Science Editor of the *Chicago Daily News*
Carroll L. Wilson, Professor of Management, M.I.T.

The First Line

Thoughtful people everywhere are suddenly aware of how technology has enabled man to increase his range and numbers and of the consequences of this for the creatures who share his environment and for the conditions under which we—and they—must live. The issues are before us daily, in every newspaper and magazine, in Presidential messages; in smog in our air, oil in the ocean, poisons on the land. Suddenly these have become our great concern and cause.

But our problems in dealing with them have only just begun. Jeffrey Ingram, who wrote about the economic issues in environmental control in last month's *Technology Review*, senses our frustration: in reviewing Loren Eiseley's *The Unexpected Universe* in this issue, he writes of "our present wallowing in doomsday rhetoric about man's destruction of his world." For ahead of us now lies a new level of experiment and action to which rhetoric is almost wholly inappropriate.

We simply do not know enough about the mechanisms which man has unleashed in air and water—the photochemistry of hydrocarbon pollutants, the chemistry and physics by which a eutrophic lake will restore itself, the distribution of instabilities in streams, the consequences and control of sulphates . . . a host of fundamental problems which relate to the exquisite balance in which Earth's environment has developed. We must move—as best we can—within the limits of our present intuition; but we must most of all remain aware of our most fundamental ignorance.

An educational institution has before it the same temptations and choices. In his first report to the faculty this winter, Professor Kenneth N. Hoffman, Chairman of the prestigious Commission on M.I.T. Education, said that "a very deep understanding of the effect of technology" should be one of M.I.T.'s priority goals. "Our thinking must cut far deeper than the conventional question of humanism for scientists," he said. We must learn "an awe in the face of the cosmic."

Our next stage is to penetrate beneath this resolution, to the practical issue of

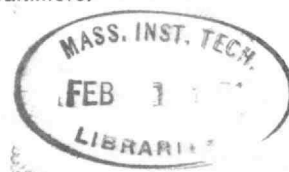
what can we now do—and how can we truly do more in the future. Shall we, for example, now measure the amount of sulfur in the fuel with which we heat our buildings, so to control the sulfur dioxide which we contribute to the atmospheric burden? (Can we afford the cost of low-sulfur fuel, or the greater cost of SO₂ removal equipment?) Shall this magazine insist that its paper come from a mill which least violates the stream into which its water flows? (And pay its share of the price for the cleansing operations—as well as for the privilege of being selective—on a budget painfully pressed.)

And how shall we as an educational institution fulfill the broader responsibilities of education and research on such unconventional and complex issues? Carroll L. Wilson, M.I.T. Professor of Management, drew on his experience in developing urban management and underdeveloped nations programs at the Institute to give the M.I.T. Commission a pessimistic report: "The indispensable ingredient for getting anything moving in the world is an entrepreneur who is prepared to commit his reputation, time, patience, and everything else necessary to make the project work." But an educational institution is conservative, traditionalist. "I am appalled that practically every reward," he said, "goes to those who specialize within a discipline . . . In a new field which is a combination of various established disciplines, unless you have a structure which allows the people involved . . . to get appointments and tenure, and to give courses and degrees, you're up against real obstacles."

The point is to recognize that much of today's oratory is a symptom of our problems—not a solution at all.—J.M.

This Issue

Of the seven papers in this special issue of *Technology Review*, five—those by Dr. Bennett and Professors Fein, Munro, Seibert, and Yerby—are drawn from presentations at the 1969 Alumni Seminar. The *Review* is grateful to the Seminar Committee and the authors for their help in extending this material to the wider audience it deserves. The cover and drawings throughout are by Dill Cole Eucalyptus Tree Studios, Baltimore.



Technology Review

Articles

A special issue on the promise and frustrations in the joining of technology and medical care:

Health Care Systems—Some International Comparisons 24

Dr. Alonzo S. Yerby
What happens when Ivan, Geoffrey, and John need a doctor

Financing U.S. Medical Care 28

Rashi Fein
U.S. health care is fragmented and inefficient; from this follows the case for national health insurance

New Technology and New Medical Education 34

William M. Siebert
As technology changes medical practice, medical education must change; and technology can help

Conditions and Problems of Technological Innovation in Medicine 42

Dr. Ivan L. Bennett
"Would you please tell me which way I ought to go from here?" "That depends a good deal on where you want to get to."

A Note on the Impact of Technology on the Practice of Medicine 49

Dr. Robert H. Ebert

Nutrition and Human Evolution 50

Hamish N. Munro
Nutrition seen as an example of how scientific knowledge has affected medical care

The Computer's Role in Health Service Research 56

Dr. G. Octo Barnett, Dr. Jerome H. Grossman, and Dr. Robert A. Greenes
No one—except the doctors—doubts the power of computers. What we need is many experiments

Promises, Promises—But Few Wedding Bells 61

Samuel Moffat
Electronic gadgetry is everywhere. But what about the patient who still wants to talk to a doctor, not a computer?

Departments

Science Review

Moving enzymes from academic laboratories to industrial production
Robert C. Cowen

European Report 10

Another report on the European community's effort to achieve its own enriched uranium in centrifuges
Daniel S. Greenberg

Washington Report 12

If you're worried about population and pollution, join the club of "pollution" watchers
Victor Cohn

National Report 14

What scientists really watched during eclipse
Victor K. McElheny

National Report 16

The National Academy of Engineering is changing its voice
Clyde C. Hall

Book Reviews 18

Rudolf Arnheim, William A. Higinbotham, Jeffrey Ingram, and Fred Wheeler

Puzzle Corner 88

A diversionary tactic involving integrals and pentagons
Allan J. Gottlieb

Tech Crostic 90

Having to do with statistical theory
David L. Holt

Correspondence Review 92

Our readers' views of radicals and other issues

Trend of Affairs

An argument for inserting, instead of removing, bottlenecks 69

Another version of the 150-mi./h.-train vision comes from Britain 69

Pollution is an uncontrolled change in a controlled system 70

Full-spectrum color in liquid crystals: changing faster and faster 71

8 Climate is a complex of complexities which may defy prediction 71

Insulating a 1,200° C. furnace with a lining of gold leaf (price: 2¢) 72

The intercontinental migration of dust: 1 million metric tons in six days 73

A high-temperature conductor demonstrated in a red-hot motor 73

The "properly packaged" human is hardly the one in the automobile 74

When the airplane drops 2,000 feet, it's the Kelvin-Helmholtz instability 74

An integrated control system by which one set of pests manages itself with others 75

Black entrepreneurs in the super-market business: prognosis poor 75

The National Accelerator Laboratory on the side of human rights 76

Infrared astronomy: seeing the unthinkable in "a new realm of physics" 77

The ocean rivals man as a source for the atmosphere's carbon monoxide 77

Psychology vs. science: the problem is with the ants, atoms, and aardvarks 78

Cambridge Journal

The "spherical senselessness" of the anti-ballistic-missile argument 80

Vote no on the Geneva protocol—even if you want to end CBW 82

A political scientist turns to the gritty issues of public transport 83

A Nobel Laureate's ode to Sweden . . . 84

. . . and his advice for the future 85

How the American university can work toward really making a difference 86

"Wanting more food from the ocean is one thing. Getting it is another," says Art Tuthill of International Nickel.

"Extracting food from the ocean in large quantities takes special machinery.

"Special machinery to get the food.

"Special machinery to process the food.

"Special machinery to transport the food.

"And most important, special machinery that can stand up to the sea.

"Machinery made of materials that will last. Reliable materials priced reasonably enough to make large, intricate machinery self-sufficient and financially practical.

"That's my job at International Nickel," says Tuthill. "Working with the marine industry, interpreting their needs to our researchers. In an effort to develop special materials that will resist the sea's extreme pressures and corrosion.

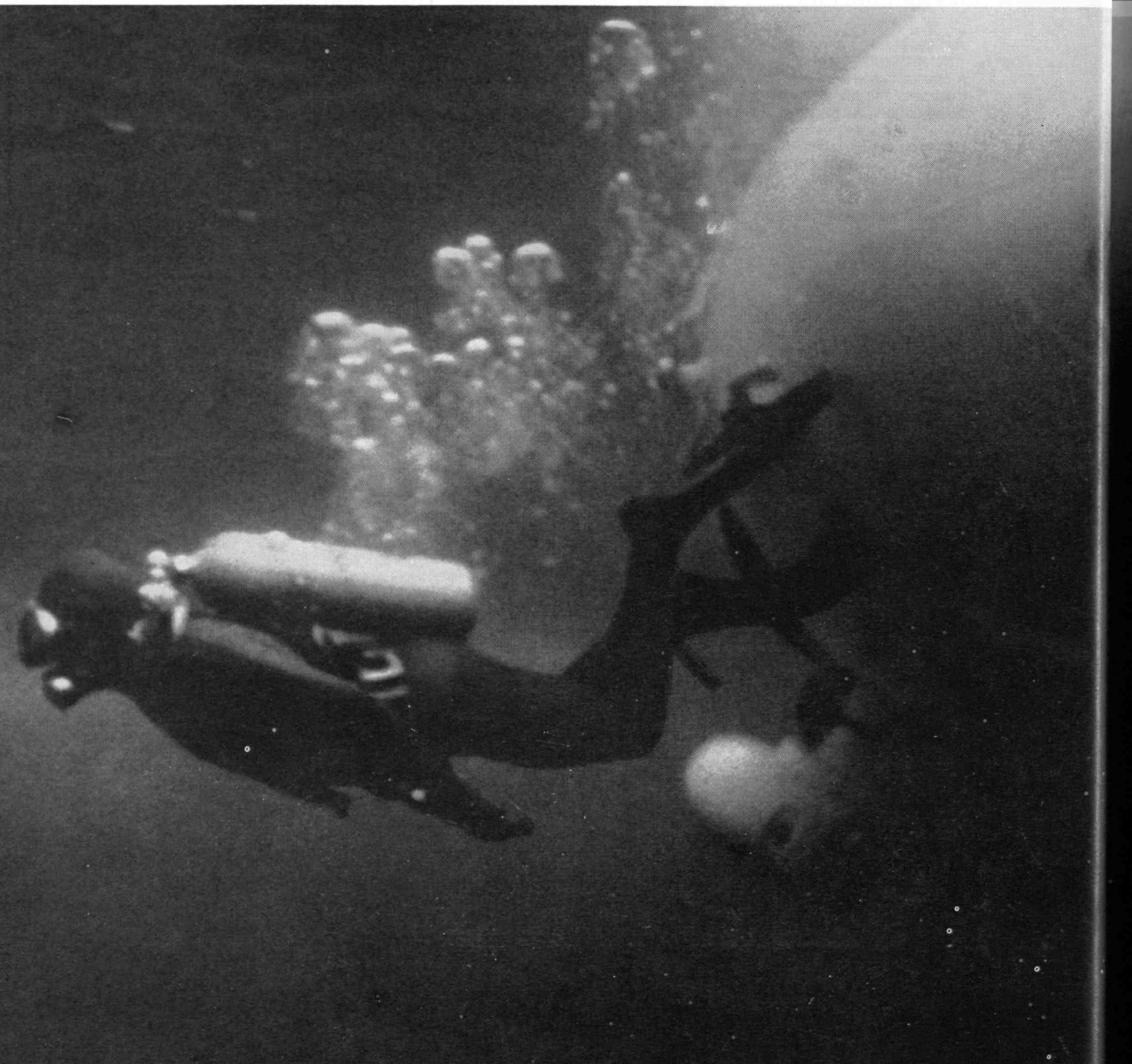
"We already have alloys of copper and nickel, nickel alloy steels and certain stainless steels, that fulfill these requirements.

"Nickel maraging steel enabled Lockheed's *Deep Quest* to dive to a record depth of 8,310 feet withstand fantastic pressure and stress.

"Copper nickels have made desalination possible at reasonable cost. And are beginning to find a home in all kinds of boats that work the sea. Fighting hard against salt water corrosion.

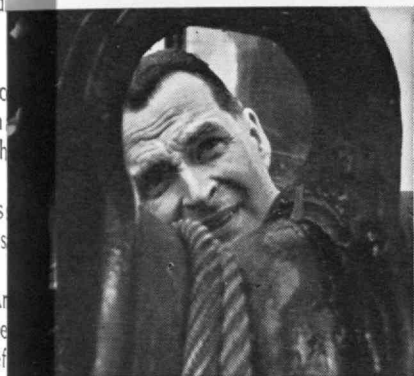
"And special grades of stainless steel assure the sanitary conditions necessary for processing the catch.

"We have the materials now. And the faster they're made into machinery the sea can't destroy, the faster the relief



Machines the sea can't destroy.

one billion underfed people of
world."



Nickel helps other metals resist heat, cold, impact, pressure, abrasion, corrosion... to advance engineering in vital fields—power, desalination, electronics, transportation, aerospace.

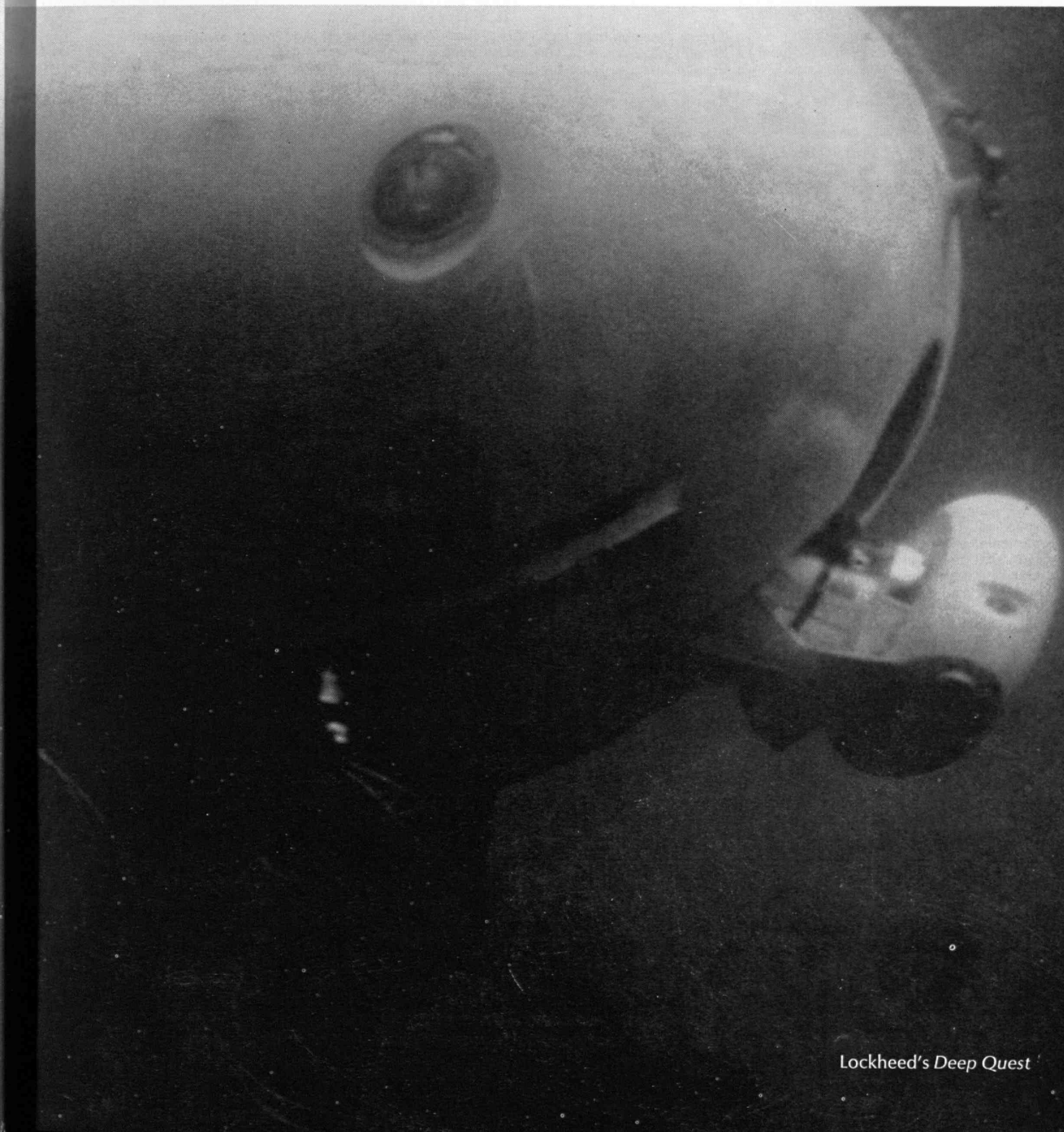
We're doing everything we can to produce more nickel. Searching around the world—Indonesia, Australia, Guatemala, Canada. We've found ways to extract nickel from ores thought too poor to mine a few years ago.

We count our blessings and respect our surroundings. From nickel ores, we recover platinum, palladium, twelve other commercially useful elements.

Make iron pellets for steel. Convert smoke in our stacks to chemicals for other industries. On sand left from processing ore, we grow meadows of hay.

We are explorers. We're in 18 countries. Miners, researchers, market builders—we bring opportunity to underdeveloped lands, new technologies, new payrolls, new tax income. Nickel in the ground is useless. We put it to work.

INTERNATIONAL NICKEL



Industry now uses enzymes which are cheap and can be thrown away. A University College team is working on production of costlier enzymes with long working lives

Industrial Role for Costlier Enzymes?

Eager to make research turn a profit, Britain is prodding its academics to pool their talents on industrially promising work. This may sound quaint to Americans, who take team research for granted. But the concept is a little startling for British universities, where specialists traditionally stick to their fields. Getting some of them to fuse their work into the right projects could generate a kind of hybrid vigor.

The Science Research Council thinks it's got this kind of thing going in an effort to use nature's catalysts, the enzymes, to build a new technology for chemical manufacturing.

Drug houses and some other types of companies have used enzymes for years. You run into them in meat tenderizers, and in the new detergents, too. But 98 per cent of the enzymes used in living cells have yet to be isolated and studied, let alone put to industrial use.

Yet these enzymes are hundreds of thousands of times more efficient in pepping up chemical reactions than any other catalysts known. They act very specifically: one enzyme stimulates one particular chemical reaction—cleaves a particular protein molecule, or adds a unit to it. If chemical engineers could get their hands on enough of the right enzymes, they could redesign many processes to be more efficient, and some entirely new processes would become possible.

The trouble is, the enzymes used today are fairly cheap and easy to come by. That's one reason they are used. You can get them in quantity, and you can afford to just use them and throw them away.

The enzymes we're talking about here would typically cost you tens of thousands of dollars a gram, if you could get a gram—they're generally available only in microgram amounts. So the keys to a new technology using enzymes are mass production of the enzymes themselves and ways of using them repeatedly to conserve such valuable material. While a number of countries are working on this, Britain has done much of the pioneering. Its effort now is strongly focused in a

30-man research team under Drs. Peter Dunnill and Malcolm D. Lilly at University College, London.

Keeping an Enzyme at Work

Since the mid-1960's, Drs. Dunnill and Lilly have been learning to extract enzymes more efficiently from various kinds of living cells. They have found ways to make these normally soluble chemicals insoluble. They anchor them to such structures as cellulose strands or cloth fibers. With an enzyme so anchored, a chemical to be processed can flow past it without carrying the enzyme away. The enzyme then becomes a reusable part of the production plant.

While such enzyme technology is still in its infancy, it is obviously going to take off in the seventies. Drs. Dunnill and Lilly feel they know enough now to carry through a research program that will enable Britain to stake a sizeable claim in the world of this new technology.

The Science Research Council agrees, and last year it underwrote the project with a five-year grant of £200,000 (\$480,000), enabling a team of chemical engineers, biochemists, and some other specialists to carry out an extended program. This is one of the larger and longer-running S.R.C. grants, and one of the very few made specifically to encourage interdisciplinary research. As S.R.C. puts it, it's the kind of grant it likes to give "in order to make its support of university research more selective and ensure its resources are being used in the most effective way."

Dr. Dunnill says, half seriously, that S.R.C.'s sense of priority shows up most tellingly in the fact that it has given the project a secretary—a virtually unprecedented luxury under the austere provisions of S.R.C. grants. So, although Drs. Dunnill and Lilly are only university lecturers (equivalent to assistant professors), they have a grant and a project that full professors and heads of university departments envy.

They're tackling their problem along three parallel lines. They're developing ways to extract enzymes in continuous processes and several at a time. They're learning better ways to anchor them to

solid supports. And they're studying basic enzyme characteristics—which leads to knowing how to adjust the levels of desired enzymes in the bacteria, or other cells, that make them.

While biochemists know how to extract enzymes from living cells, they generally do it one enzyme at a time and one batch at a time. As Dr. Dunnill explained during a visit to his lab, continuous processing trims down production equipment: You don't need large holding tanks for various stages of the processes. It makes product control easier: sensitive enzymes spend less time mixed up with other enzymes that might degrade them, or in the harsh environment of an acid used at one stage of extraction.

Once, for example, the team was extracting an enzyme from beans by a fractional precipitation process in which the enzyme was freed by an acid. They were getting heavy losses in the enzymatic activity of the product. So they made the whole process continuous. Ground-up beans were stirred with a buffer solution and passed through a scroll- or cork-screw-type centrifuge, which removed the husks. The liquor from the centrifuge merged with an acid stream, forming a precipitate. A second centrifuge took out this precipitate, ejecting a clarified liquor which again merged with an acid stream. The precipitate which then formed contained the desired enzyme. Individual enzyme molecules spend far less time in the acid than they did during batchwise processing.

The University College team has enough experience with continuous processing to be convinced it is both feasible and preferable. Ultimately, it could be computer-guided, which would allow finer control in mass production than would batchwise processing.

While industrial chemists thought the group's ideas for continuous processing rather ambitious, they just shrugged off suggestions of multiple extraction. "They told us that just wasn't on," Dr. Dunnill said. You could optimize for one product, but optimizing for several would be fiendishly complex.

Well, complex or not, the University Col-

lege team has done it in their laboratory. They've learned enough for Dr. Dunnill to believe this too will be a basic part of enzyme technology in the seventies.

Making 20 Enzymes at Once

He took obvious delight in showing a chromatographic column from which 20 different enzymes were coming off, one after the other, from the same source material. These are the enzymes, known as amino acid activators, associated with the build-up of protein molecules from their 20 constituent amino acids in living cells. Biochemists at the Medical Research Council Laboratory in Cambridge wanted to study all 20 enzymes. They figured it would take them ten years to get all 20 by their one-at-a-time batch extraction methods. The equipment in Dr. Dunnill's laboratory was pulling out the enzymes within a few weeks; and in the next room, a new chromatographic apparatus was being built for continuous extraction of such enzymes.

Scaled up to industrial size, such processes should make a multitude of enzymes available in unprecedented quantities within this decade. Even with the economies of such production, though, most enzymes will still be too expensive to throw away after one use. They will be capital equipment; hence the need to anchor them down.

The crucial problem is to produce a catalyst that will be stable for, say, six months, not just a couple of weeks. The group has worked with one tied-down enzyme (penicillin amidase) for 11 weeks without deterioration. It also has run another enzyme (amyloglucosidase) for a hundred hours at 55°C. That's quite hot for an enzyme. With this experience, Dr. Dunnill said, "the prospects look bright."

He explained that, among other advantages, the anchoring seems to make enzymes less sensitive to temperature or handling damage. While no one really knows what's involved, he suggests that anchoring restricts molecular vibration. One way an enzyme molecule may degrade is to unfold and then have trouble folding back up again. If anchoring restricts such movement, it would make the molecules less sensitive to higher temperatures.

Looking far ahead, Dr. Dunnill speculates that it may one day be possible to dispense with the anchoring by making fully synthetic enzymes. He's thinking of large sheets with enzymatic properties at their surfaces—not synthetic enzyme molecules.

Enzymes get their unique catalytic ability partly from their physical properties. A particular enzyme molecule fits a molecule of the particular chemical it transforms, as a lock fits a key. Moreover, the enzyme has a certain limited ability to manipulate, to facilitate snipping bits off a molecule or adding bits to it. Perhaps biochemists will eventually understand enzymes so well that they can build this kind of object into large sheets of material.

But that's just a researchers' dream. Right now the University College team is trying to find better support materials and to learn more of the fundamentals of the new enzyme technology generally. While they have had good luck using cellulose to support enzymes, they can't easily build that material into useful shapes. They're looking at synthetics and cloths, and may even turn to glass.

Dr. Dunnill sees a tremendous gap to bridge between their laboratory work and industrial processes. Yet a long distance to go doesn't necessarily mean a long time traveling it. Dr. Dunnill thinks the field is developing very fast. The next two or three years should begin to see industrial applications, he predicts.

Will Britain Lose the Lead?

He looks a bit anxiously at other countries, especially Japan and America, which are also working hard on enzymes. In fact, he's heard reports of a Japanese plant using anchored enzymes to convert certain amino acids into food supplements. Since it reportedly turns out 40 metric tons of product a month, it's not, he notes, "just a pilot plant."

"I'm apprehensive for Britain," he explains, "because industry here is so conservative. It will take a lot of persuading, anywhere, for a chemical manufacturer to scrap existing plant and start over again with enzymes just to get more efficient processing. The first use of the new tech-

nology will probably come where a relatively cheap material is upgraded to a relatively expensive one. That means things like pharmaceuticals. But in Britain our industrialists may even hold back on doing that."

He adds that "in emphasizing basic research on enzymes and enzyme technology, we're trying to make the most of something we're rather good at. But we're not so good at turning laboratory results into industrial processes." Once again, Britain faces an opportunity to capitalize on its native scientific genius. And once again, its biggest handicap appears to be the less adventurous side of its national character.



Robert C. Cowen, who studied meteorology at M.I.T., is Science Editor of the Christian Science Monitor. He is spending this year—and next—in London to focus his reports on scientific and technological affairs in Europe.

The three-nation agreement to develop ultracentrifuge uranium production "makes a kind of economic and political sense that has heretofore been lacking in most of Europe's efforts at multinational cooperation in science-based industry"

Cool Logic on International Technology

The recent Anglo-German-Dutch decision to build and operate gas centrifuge plants for the enrichment of uranium, described by J. R. Redeker in this space last month, is easily overlooked in Europe's plethora of talk and paucity of results concerning large-scale technical cooperation. Now past the point of formal ratification by the three nations, this is a deal with a difference, and it merits notice not only because it is likely to free Europe from near-total dependence on U.S. enrichment facilities but also because it makes a kind of economic and political sense that has heretofore been lacking in most of Europe's efforts at multinational cooperation in science-based industry.

To take full measure of the difference, it is useful to examine the centrifuge plan and then compare it with some of the technological landmarks of the doleful past. At present, Europe has three sources of enriched uranium: gaseous diffusion plants in France and Great Britain, which even together are not great in terms of overall European needs, and the gaseous diffusion plants of the U.S. Atomic Energy Commission, which, at the moment, have ample capacity to take care of everyone's needs. Though the development of nuclear power is now in the unusual state of falling behind expectations rather than exceeding them, it can be reasonably calculated that an enrichment deficit will begin to appear by the mid-1970's. Given the required lead times for building the necessary plants, the issue that now arises is whether Europe should assume and rely on an expansion of U.S. productive capacity, and, in so doing, accept long-term American domination of this booming field. Or should she go about assuring herself a reliable supply?

Given Europe's concern, inchoate as it may be, over American technological superiority, it was perhaps inevitable that a sympathetic reception awaited the case for home-based facilities. However, the particular type of process chosen—centrifugation—produced shudders in many governments, since it has long been looked upon as a relatively inexpensive, though technically very difficult, route to nuclear status. The point is debatable; but there is no doubt that, if the

technology can be achieved, centrifugation offers sizeable advantages compared with the gaseous diffusion process.

First of all, it is said to consume considerably less power—perhaps a tenth as much for a given output, though there is some contention over the estimates. Second, in contrast with the elephantine scale and matching costs of the gaseous diffusion process, centrifugation can start small and grow to whatever desired scale simply by adding more centrifuges.

The difficulty, of course, is that the centrifuge speeds that are necessary for isotope separation, combined with the corrosiveness of the uranium feeds, provide an engineering nightmare that readily explains why the process was examined and abandoned in the early days of the Manhattan Project—and then long afterwards widely regarded as unsuitable for industrial-scale operations. (The suspicion widely persists that the U.S., with its vast investment in gaseous diffusion and its desire to restrict the spread of fissile material production, has not been ill-disposed to emphasize the complexities of centrifugation. Official practice is to say little about the process, outside of casting doubt on its feasibility and economics.)

A Down-to-Earth Departure

The Anglo-German-Dutch decision to join forces and go ahead with the process on an industrial scale proceeds from a combination of technical, economic, and political factors. For purposes of commercial advantage, as well as reasons of concern over the proliferation implications, very little is publicly available on the technology of the process. But each of the partners has something important to contribute. The conceptual breakthrough is credited to a German physicist, G. Zippe, who proposed the use of lightweight rotors, jewel-supported on the bottom, magnetic-supported at the top, spinning in a vacuum. Britain's pioneering work in carbon fiber technology is said to have opened the way to the development of relatively inexpensive and durable materials that could endure the operating strains. And the Dutch are said to have made a variety of important contributions, including the engineering work on the suspension system.

Economically, there is no doubt that there will be a market for any competitively priced fuel which emerges from the system. And politically, the consortium provides a simple answer to the dilemma of Germany's rapidly growing appetite for nuclear fuel and the widespread foreign uneasiness about her achieving nuclear self-sufficiency. Under the three-nation agreement, enrichment plants will be built in Britain and the Netherlands, while the administrative headquarters will be situated in Germany.

The striking aspect of the consortium is this: it is a down-to-earth departure from the sort of starry-eyed but ill-fated schemes that have long plagued Europe's efforts to combine for competition with the United States. And perhaps most important, the new consortium differs from most of its predecessors in that it flows naturally from technical and commercial factors rather than from the political or prestige motives that often are seized upon as convenient excuses for uneconomic or ineffective technology.

The Illogic of Competition, Pride, and Politics

Compare, for example, Euratom, which was created by the Common Market a decade ago to pool resources in the nuclear field. Today it exists just short of disintegration, starved of funds, and at best ancillary to the profit-minded national programs of the member nations. The diagnoses vary, but they all at least take note of the fact that in the highly competitive nuclear field, Euratom exists simply as a research organization—without strong links to a commercial or industrial organization that could transform its work into marketable products. As nuclear energy approached the stage of commercial payoff, Euratom's sponsors almost inevitably turned inward to support their own research and production programs instead of putting major resources into a community effort whose results would be available to all. In a technological sense, they did not need each other to proceed successfully, which is not the case with the centrifuge consortium. Not only do they need each other, but from the start they will be in business together.

In aviation, the Anglo-French Concorde is

a kind of monument to multinational cooperation in a difficult and expensive field. But it is a case of a technological enterprise being undertaken for prestige reasons—on the part of the French—and for political reasons—on the part of the British, who erroneously assumed that it might tip French sentiment in favor of British entry into the Common Market. It is possible that the Concorde may prove economically viable, but along the way the venture has proved to be so far in excess of original cost estimates that Britain long ago would have got out if not bound by an iron-clad, penalty-laden contract. If ever there was an example of technological cooperation for the wrong reasons, it is Concorde.

Aviation currently offers another example of departure from the cool logic that underlies the centrifuge agreement. Britain has pulled out of a scheme to build an all-European "air bus," ostensibly on the grounds that there is no evidence of a waiting market. Meanwhile, France, Germany, and the Netherlands are going ahead, egged on in large part by German determination to acquire a place in aircraft manufacture. The British Aircraft Corporation—if it can get government support, which, at this writing, seems likely—is prepared to build an all-British airbus, though there is no evidence that it will be any more marketable than its European counterpart.

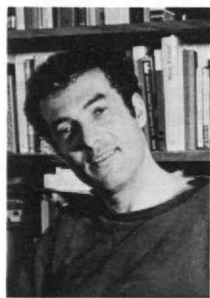
Motives of prestige, fear of American dominance, and a desire to keep abreast of the technology all combine to keep a European space program alive—moderately successfully on the research side, just barely on the launcher side. But again, unlike the centrifuge deal, the vital ingredients of real need, commercial payoff, and dovetailing contributions are lacking or in short supply. Britain has pulled out of efforts to develop an all-European launcher. And France has indicated an intention to scale down its contribution to the European Space Research Organization, which is the agency for developing and operating scientific payloads.

Toward Nuclear Proliferation?

Other cases of faltering or ill-conceived cooperative efforts can be cited, but perhaps these few will suffice to indicate

why the Anglo-German-Dutch centrifuge agreement is of a different order from past efforts to pool Europe's resources in advanced technology. What remains to be considered are the effects that the program may have on nuclear proliferation.

Dire predictions have been made; but it is difficult to support the fear that centrifugation will open the way for a further spread of nuclear weaponry. The process has been referred to as the "poor man's" way to join the nuclear club, but it is, in fact, neither cheap nor easy to accomplish. Britain, Germany, and the Netherlands are, after all, among the most technically sophisticated nations in the world, and by all accounts they have not found it easy to work out a successful process. Nations that desire to go nuclear need not rely on centrifugation. There are other ways. Finally, though the process is easier to conceal than gaseous diffusion (no huge, tell-tale power sources being necessary), it is difficult to conceive of significant uranium enrichment and weapons fabrication taking place anywhere in the world today without some word leaking out. The day of the basement-made bomb is fortunately still remote.



Daniel S. Greenberg is stationed in London as Foreign Editor of Science; he is the author of The Politics of Pure Science and a number of articles in the popular and technical press.

BUILT BY
W. J. BARNEY CORP.



Chas. Pfizer & Co., Inc., Research Lab.
Shreve, Lamb & Harmon Associates, Architects

70% Repeat Business!

It is a great satisfaction that year after year more than 70% of our contracts for construction projects has come from those for whom we have built before. Many of these we have served continually for 30 or 40 years or more.

W. J. BARNEY CORPORATION
Founded 1917

INDUSTRIAL CONSTRUCTION

360 Lexington Ave., New York, N. Y. 10017

Alfred T. Glassett, '20, President
Robert F. Lathlaen, '46, Vice-President

KULITE

METALLURGY

Tungsten, molybdenum, cobalt, special alloys — fabrications. "HI-DENS" tungsten alloys — for counterweights and shielding.

SOLID STATE SENSORS

Semiconductor strain gages, integral silicon force sensors and temperature sensors for measurement and control applications.

Anthony D. Kurtz, 1951

Ronald A. Kurtz, 1954

KULITE

(Kulite Semiconductor Products, Inc.,
Kulite Tungsten Corporation)
1030 Hoyt Avenue, Ridgefield, N. J.

"All right now, fellows, politics or poker, which is more important?" The question of an anguished card player in "Fiorello," the 1959 Broadway musical, has its modern counterpart; and, says Mr. Cohn, "we had better be prepared for a long pull on both the politics of the environment and the politics of social reform."

Politics or Popullution?

All right now, fellows, politics or pollution, which is more important?

The answer has to be both, and we are now seeing a remarkable performance in which the country's politicians—something like the players in "Fiorello"—are simultaneously inveighing against pollution and shuffling the political deck. Richard Nixon and Ed Muskie are vying for the national crown of Great Anti-Polluter. Ronald Reagan and Jesse Unruh are playing the same show in dirty California. Ditto the people of politics in other states.

The competition is fine. The need is desperate. There is no denying that President Nixon has become the first U.S. president to set out a real antipollution program. Or that Senator Muskie pressed the issue long before it became politically sexy. Or that politics is the essential fuel for our government's engine.

But there are dangers, too, in this intensely political start of America's first crusade for the environment since the days of Teddy Roosevelt. The main dangers, it seems to this reporter, are:

◇ A pollution of overpromise accompanied by weak, underfinanced effort that will lead to the usual scenario for Great American Crusades (e.g., civil rights, urban renewal, hunger, peace): great words followed by great expectations followed by great failure followed by disillusion and apathy.

◇ Failure to grapple yet in any genuine way with some of the genuinely tough, painful, and politically unattractive problems that peoples and nations must face if the one globe we possess is to remain habitable. For one great area that Mr. Nixon did not even mention: population—or, as S. Fred Singer describes the problem, "popullution."

The Real Violators of Law and Order?

The President, to be sure, mentioned much. In the explanation of his science adviser, Lee DuBridge, "you can't put everything in one message—it was a very important milestone." It was indeed. It called for nationwide federal standards for both air and water. It proposed penalties up to \$10,000 a day for polluters. (The *maximum* penalty under the

still-standing Harbors and Rivers Act of 1899 is \$2,500.) It included 14 executive orders and 23 requests for legislation.

It was properly described in various accounts as "tough, direct, and specific," surprising all White House watchers, and a "political master stroke," slicing through "dozens of Democratic-sponsored environment bills already proposed or on the books."

It not only ignored popullution, however, but discussed neither the production of energy nor mass transportation, more basic problems that society must attack if it would maintain the environment. It made no mention of pollution of the oceans by offshore oil wells and gigantic tankers.

By specifically speaking of rivers' "assimilative capacity," it raised fears that just a little filth may be allowed in streams now unpolluted. It indeed called for possible \$10,000-a-day penalties, *if* federal prosecutors act and *if* judges choose to levy them. But even \$10,000 a day might be an acceptable pollution charge at times for some large plants.

Above all, such a message is inevitably received with some reserve by Washington's skeptics who know that cost-conscious industry as well as the environmentalists will be trying to help write the enabling legislation. How tough will the tough laws really prove when all the fine print is set down? Enforcement, after all, has always been the weakest reed in the environmental struggle. A federal prosecutor recently moved against some Midwest water polluters on the basis of the 1899 federal law, and consumer crusader Ralph Nader promptly and properly asked, "Why wasn't it enforced for 71 years? Why didn't Vice President Agnew mention these violators of law and order?"

In New York, the City Council's minority leader charged recently that "enforcement of air pollution laws is in a state of collapse." For example: the law required that 3,420 apartment-house incinerators be upgraded or shut down by December, 1968; but as of January, 1970, more than 1,900 of these bum incinerators (includ-

ing 500 operated by the New York City Housing Authority) were still burning and polluting. As of October, 1969, owners of 5,910 more incinerators were required to comply; as of January 1, 4,700 of these were still in operation. How about these violators of law and order?

Fighting Where Battles Must Be Won

So it often will go. Bold speeches, even by Presidents, do not a program make. "Pollution hypocrites" have again and again voted down bond issues to pay for water treatment facilities even while they bemoan their lack, reports Clarence Kassen, technical adviser to both the Illinois Water and Air Pollution Control Boards. "You must take your campaign where most of the important battles are fought—to the state and local levels," Senator Muskie warned students at the University of Michigan's mid-March environmental teach-in.

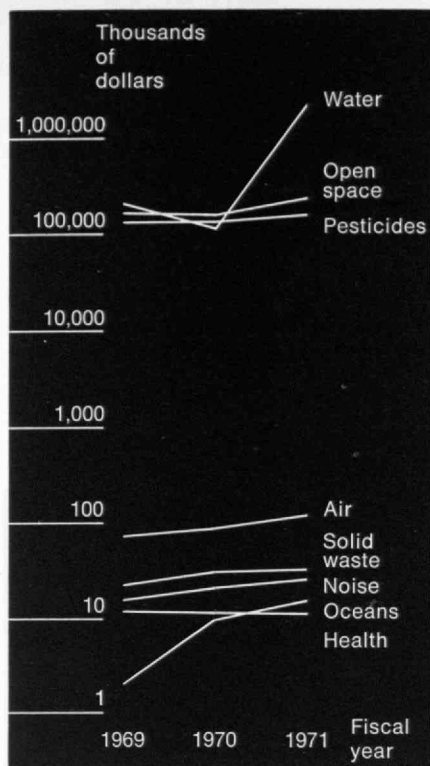
Muskie made this suggestion: organize a long-pull "Citizens' Lobby for Environmental Protection" to "voice effective demands for tough legislation" and bring pressure on industry, conducting consumer boycotts if necessary. For too long, he said, "those who have been able to afford constant representation in legislative lobbies and city halls have dominated the decision-making process—often only because of their constant presence." And, he might have added, their well-financed good fellowship over countless dinners and drinks; their campaign contributions; their expertise, very often, as well as their eternal presence at long committee meetings with facts, charts and position papers.

"There will be no change in the environment without first enacting legislative change," John Zierold—full-time lobbyist in Sacramento, Calif., for 70 conservation groups—told Californians, and he and a panel of state assemblymen came up with this added advice for concerned individuals:

◇ Stop acting as individuals. Unite. Pool finances for campaign contributions to the deserving.

◇ Be willing and *prepared* (unlike many amateurs) to explain issues to legislators, both privately and at formal hearings.

◇ Describe "every" environmental cause



The Nixon administration's budget proposals for Fiscal 1971 include a major effort for improved environmental quality. But will this first increment of a five-year program have any real significance in terms of the nation's problems? And has it any political reality? (Data: *Environmental Science and Technology*)

in terms of votes for legislators. (Which also has to mean delivering votes by keeping the issues before the public.)

- ◇ Call for positive actions (like new laws to protect shorelines) rather than merely negative actions like fines.
- ◇ Keep the spotlight on the legislators. Follow and publicize bills' progress or lack of it through the legislative machinery.

This means much time and hard work. The legislative machinery, in state house or Washington, is often intricate and deadeningly dull. Few journalists—only superspecialists for trade and special-interest papers—have time to follow all the important ins and outs as legislators ponder and pigeonhole. The odds in the long pull, as Senator Muskie notes, are indeed on the side of the pros.

\$10 Billion—or \$120 Billion?

There is also the mighty matter of money, and here alone the war against pollution may founder. The United States—in federal, state, local and industry funds—has been spending about 1 per cent of its gross national product on pollution control, or about \$10 billion. About half of this is consumed just by municipal waste collection (of rags, junk, cans, bottles and, more than 50 per cent of it, dear reader, waste paper).

The federal share of all this as of fiscal 1969 was about \$1 billion. Mr. Nixon has now proposed adding \$4 billion in federal funds over the next five years—to be added to localities' \$6 billion, making \$10-billion-worth of water treatment plants.

The Federal Water Pollution Administration, however, estimates that bringing lakes and streams to federal standards by 1973 would really cost between \$26 and \$29 billion. An Interior Department estimate says it would take between \$43 and \$66 billion in the next five years. Senator Henry Jackson believes cleaning the air would cost \$12 to \$15 billion in the same period.

Some experts go even higher. They think it would cost nearly \$100 billion—\$20 billion a year—for a real five-year clean-up. O.E.C.D. economists in Brussels think it would take a continuing annual outlay of 2 per cent of G.N.P.—just under \$20 billion in the U.S.—for a nation like ours *merely to insure that environmental deterioration is gradual*, rather than rapid. The O.E.C.D. estimate for just holding the line is 4 per cent of G.N.P. or, in the U.S., \$40 billion. Active clean-up and prevention, it feels, would cost "three or four times as much," or a U.S. annual minimum of \$120 billion.

Estimates like these tell why Senator Gaylord Nelson of Wisconsin says we should start the drive with \$20 to \$25 billion a year and quickly go to \$40 or \$50 billion, sums "equivalent to defense systems and the exploration of space."

Must We Abandon Economic Growth?

There is no doubt that much can be done about pollution at relatively low cost. We can probably have lead-free gasoline for an extra four cents or so a gallon and fume-free automobiles for an extra few hundred dollars. *Time* magazine estimates that a \$700 million annual price tag for rigorous control of industrial and power plant pollution would "add a mere 20 to 30 cents" to most users' monthly electric bills.

But Fred Singer, who is Deputy Secretary of the Interior for Science, probably comes much closer to the mark when he says that, with rapidly rising pollution, the antipollution bills will inevitably take off like a bird, and taxpayers will soon refuse to pay them, preferring pollution. And preferring industrial jobs.

"The time has come for environmental quality to have primacy over development," says a special environmental study council created by the California legislature. Mr. Nixon has pointed out that endless economic expansion may be incompatible with a clean environment, and preservationists like Harvey Wheeler (of Santa Barbara's Center for the Study of Democratic Institutions) are commonly saying: the U.S. may reach the point, perhaps in 10 years, when "the present rate of growth is absolutely disastrous and

economic growth may have to be abandoned altogether."

It will be relatively easy, on that day, for those of us who are prosperous to say, "Okay, limit us to 'x' kilowatts of electricity a month and we'll get rid of our electric typewriters and can openers. All right, we'll have to do with one family car and support public transportation. We'll accept a tax law that favors the one-or-two-child family."

But economic expansion is the traditional path to prosperity and jobs. The city fathers of Toledo are frankly reluctant to press demands on factories that pollute Lake Erie when they know some of these plants are ancient anyway and their owners may well shut them down and shift manufacturing to someplace else. *Newsweek* quotes a black steelworker who, happily or not, brings up his family in the poisonous air of Gary, Ind., and explains: "It's the bread, man. Hell, I'm getting \$5.50 an hour. Why else would anyone want to stay in this place?"

Some of the New Left and the blacks are already crying "cop-out" at the new environmentalists for flocking to the easy new target of pollution rather than sticking with even harder ones like poverty and racism. We may find it very hard to clean the environment, but it would be certainly far harder to clean up on ghettos, bad education, and poverty. What the poor and the black are saying to the environmentalists is: unless you attack both, you will not long have our support.

This is why I wrote, near the onset of this column, of our "failure to grapple yet in any genuine way with some of the genuinely tough, painful and politically unattractive problems" that must be faced if we are ever truly to face a decent environment.

The Senator Nelsons and Harvey Wheelers are aware of this. In Gary and in Washington, D.C., we had better be prepared for a long pull on both the politics of the environment and the politics of social reform.



As Science Editor of the Washington Post, Victor Cohn directs and is a principal participant in that newspaper's coverage of scientific affairs in the nation's capital. He contributes regularly in this space to Technology Review.

A total eclipse is a major scientific opportunity, a remarkable natural spectacle, and a unique demonstration of man's understanding of celestial mechanics. The eclipse of 1970 disappointed none of its audiences.

The Most-Watched Eclipse

The total eclipse of the sun on March 7, 1970, produced a major scientific success. The eclipse probably received the most intensive and sophisticated scientific examination ever from the ground—chiefly from notably cloud-free sites in Mexico—and was the first to be given full-dress space-age study.

Flocks of rockets went aloft, most of them from two bases which happened to be along the path of totality, to study the effect of the swift passage of the moon's elliptical shadow at various altitudes in the electrically neutral atmosphere, and on the layers of the ionosphere used for radio propagation.

The shadow was photographed from a synchronous-orbit satellite whose position was shifted specially for the eclipse. Two Orbiting Solar Observatory satellites were in position to look at the sun in partial eclipse. Three Canadian satellites which probe the ionosphere with radio waves from above passed over the zone of partial eclipse. Signals from the Mariner VI craft which flew by Mars last July 31, now some 235 million miles—away on the far side of the sun, were studied for effects of the sun's corona, through which they passed, and for effects of the shadow on the earth's ionosphere, which the signals also traversed.

Unprecedented as an object of scientific investigation, the eclipse was also unprecedented as a spectacle.

Not many eclipses pass over heavily populated regions, for the obvious reason that three-fourths of the earth's surface is water, and much of the rest is taken up by desolate regions like the Andes and the Himalayas, Antarctica and Greenland, the Sahara and the Gobi, and the arctic tundra of Canada and the Soviet Union.

Show Business

Technology multiplied the chances for viewing the spectacle. The eclipse of March 7 was the first to occur within easy reach of television cameras broadcasting live, and at a time when color television sets have become commonplace. In the seven years since the eclipse of July 20, 1963, when the path of

totality crossed Maine late in the afternoon, jet airliner travel has penetrated to very small airports and the number of private planes has soared—permitting unprecedented numbers of people to choose their vantage point for the Saturday afternoon spectacle.

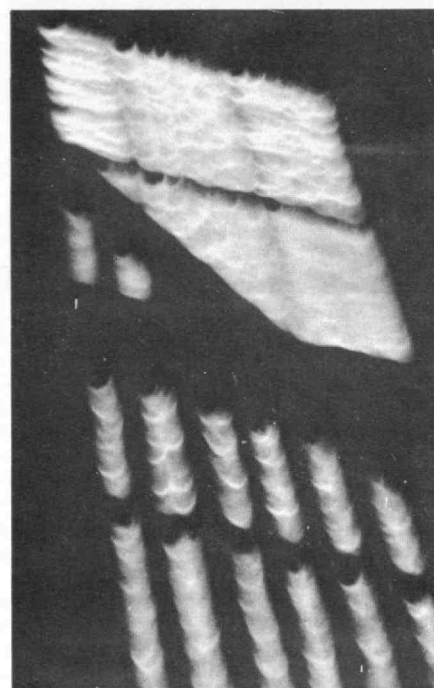
Because of all this, there had been a good deal of advance billing for the eclipse. But most of those who wrote and spoke about the eclipse in advance—this writer included—had never seen totality. So they did not emphasize the sharp difference between totality and an almost-total eclipse.

Many people assumed that the sky would truly darken when they were told that most of the eastern U.S. would see an eclipse at least 90 per cent total, and that the eclipse would reach 96.5 per cent of totality in Boston, or 96 per cent in New York. But it turned out that even a small sliver of sun at an elevation of 37° above the southwestern horizon is quite enough to illuminate the whole sky, so that daylight waned only slightly, to a dawn-like pallor and chill.

Only those who had put themselves in the path of the moon's elliptical shadow as it raced across the earth at about 1,500 miles an hour could see the startling, all-too-brief view of the sun blotted out completely by the black disk of the new moon, now surrounded by an icy-white halo—the corona—which gave a pearl-gray glow with the brightness of several full moons to that quarter of the sky. For up to 3½ minutes in Mexico, and 2 minutes on Nantucket Island, the sky was almost black, except for a ring of pre-dawn blue and pale-red twilight all around the horizon.

The widespread coverage of this eclipse, revealing the truly spectacular experience of totality, has stimulated unusual interest in future eclipses.

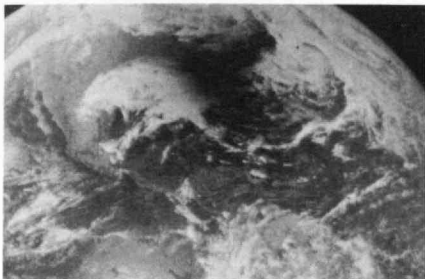
An early opportunity occurs only two years from now, on July 10, 1972, when the path of totality will run from Sakhalin Island and the Kamchatka peninsula over northern Alaska and Canada (it will be central at noon at 67° N. latitude, 111° W. longitude, above Victoria island), across Hudson's Bay and Quebec to the



Gaspé peninsula and the Maritime Provinces late in the afternoon. For viewers in eastern Canada, the length of totality will be 2 minutes, 10 seconds.

A less accessible but more spectacular eclipse occurs June 30, 1973, above the Sahara and east Africa. The moon's shadow will travel from Brazil across the Atlantic and into Africa. It is to be central at noon at 19° N. latitude, 6° E. longitude, a point in the Saharan republic of Niger.

On the way home from Nantucket, where the view of the eclipse for several thousand visitors had been flawless, a party of people who had bought seats on a chartered jet was told by Bradford Washburn, the Director of the Museum of Science in Boston, that he was half-seriously pondering the notion of a charter flight to the Saharan eclipse—including stopovers in Paris for bright lights and in Cairo for pyramids. His half-joking idea, relayed in a newspaper account, has already stimulated some telephone inquiries.



The nearer and the farther view: On the opposite page, an eclipse-viewing system which the instructors of the public seem not to have mentioned—light from a window forms an array of solar images on the living-room carpet of reader H. Frederick Schaefer, Jr., of Rockport, Mass.

Above, A synchronous satellite, ATS-3, took this sequence of photographs as the moon's shadow moved north-east from the Gulf of Mexico, up the East Coast of the continent (past Rockport, Mass.) and out into the North Atlantic. The shape of the West Coast is visible to the left of the central cloud mass in these N.A.S.A. photographs.

Both this eclipse and another one of equal length 18 years and 11 days later, on July 11, 1991, which is to be central at noon above Mexico, are expected to draw large parties of astronomers because of the length of totality and the probability of cloudless skies.

The last total eclipse for the continental U.S. in this century is to cross the state of Washington, the northern panhandle of Idaho and northwestern Montana, February 26, 1979, before pushing on to Saskatchewan, Manitoba, Baffin Island, and Greenland.

Eclipsology

The interest to be found in such recurring eclipses of the sun goes beyond the fleeting scientific opportunity to observe highly energetic processes close to the solar surface or a sudden change in the sun's impact on the earth's upper atmosphere. It also goes beyond the spectacle of the sun blotted out for a few awesome minutes.

For the nonscientist passenger on this rotating platform in space, an eclipse focuses attention on some of the accumulated knowledge about the rules governing the recurrence of eclipses.

One of the best summaries of this is an article about eclipses in the 11th edition of the *Encyclopedia Britannica*, (Volume VIII, pages 887-895), by the American astronomer Simon Newcomb (1835-1909). Newcomb was a major student of the motions of planets, asteroids and, above all, the moon. He gave much study to the problem of an apparent speed-up in the moon's motion around the earth, seemingly due to tidal frictions between the earth's oceans and the sea floor, which changes slightly the times and places a total solar eclipse occurs.

Major factors in determining the characteristics of eclipses are that the moon's orbit is both eccentric (carrying it between 221,000 and 252,000 miles from Earth) and inclined 5° to the plane of the earth's slightly eccentric path around the sun.

Imaginary lines can be drawn between the two points where the moon's orbit crosses that of the earth around the sun, and between the moon's closest and farthest point from Earth. The first line, called the line of nodes, rotates through space in a sense opposite to the moon's motion around the earth at a rate of 1.5° a month, making a complete revolution once every 18.6 years. This fact is important not only for solar eclipses but also for occultations of radio sources by the moon (which have been observed in order to improve the accuracy of location of radio sources, including that of the first quasar). The other line, between the moon's perigee and apogee, rotates through space in the same direction as the moon's travel around Earth with a period of 12 years.

As it happens, there are at least two and as many as five times a year when

the moon is on the sunward side of Earth (new moon) and close enough to the plane of the earth's orbit to cause at least a partial eclipse.

Because of the motion of the line of nodes, circumstances of an eclipse are very nearly the same every 18 years, 11 days and about 8 hours.

The eclipses that fall at this interval themselves are part of an even longer cycle that takes some 1,200 years to complete, and which involves the movement of the line between apogee and perigee.

The cycle begins with the tip of the long cone of the moon's complete shadow, or umbra, pointing out into space above, say, the north pole. The tip of the cone moves closer to the earth, and gradually begins to cause partial eclipses. Then there is a total eclipse in the polar regions (or possibly a ring-shaped—annular—eclipse, if the moon happens to be far from Earth).

Every 18 years, the eclipse moves farther south, and because the interval is roughly 8 hours longer than a full day, it occurs about 120° in longitude west of the previous one. An example of this is the repetition in Mexico in 1991 of the Saharan eclipse of 1973.

As the eclipses move closer to the equator, the duration of totality grows greater. Newcomb mentions that the series of eclipses which includes that of 1970 will eventually lengthen so that the one occurring June 25, 2150, over the Pacific will last 7 minutes, 15 seconds, and the one south of Madras in the Indian Ocean on July 5, 2168, will last 7 minutes, 28 seconds, which Newcomb says will be "the longest in human history."

Spiraling around the earth, appearing in roughly the same longitude every 54 years (thus accounting for the prediction of an eclipse much like that of March 7 on April 8, 2024), the eclipses move away from the equator, shortening again, and eventually pass out into space below the South Pole.



Victor K. McElheny is Science Editor of the Boston Globe and a regular contributor to this department of Technology Review.

The National Academy of Engineering, now five years old, "is growing up from shy and diffident childhood into a more confident youth. . . . What it says is becoming more articulate, resonant, and self-assured—sounds of an inner-directed young man."

The Simplest of Reasons

On its fifth birthday, the National Academy of Engineering is looking to the 1970's as the decade in which to reach its majority by building sturdier bridges between the engineer and society.

For example, consider the sentences with which Eric A. Walker, President of the Academy, closed its session on engineering and urban problems last fall in Washington: "Engineering deals with people—and people live in cities. For this, the simplest of reasons, the Academy must make a strong commitment to the betterment of life in the United States through working to improve the cities in which her people live."

The basic issue that confronts the N.A.E. is whether to continue its rather passive role with reference to socio-economic relationships, or whether to become more activist. Since its inception, the N.A.E. has been more outer- than inner-directed. Young and self-conscious, it has mimicked its successful big brother, the National Academy of Sciences, putting a best foot forward to meet imagined outer-source pressures to prove itself. Consequently, N.A.E. shied away from the challenges of the first two (of six) "objects and purposes" of its charter and settled for the less aggressive implications of the third: "To advise the Congress and the executive branch of the government, whenever called upon by any department or agency thereof, on matters of national import pertinent to engineering."

Passivity is inherent in "advise" because action follows initiation by others, a kind of shadow response—doing another's, rather than one's own, thing. Under this third purpose, the N.A.E. awaits a call for help from either the legislative or executive side of government. Such requests come to the N.A.E. automatically. The problem that stimulates such a request is often critical for the nation, and no one in the N.A.E. minimizes the importance of this government-Academy relationship. Item 3 among N.A.E. purposes will therefore continue high on the N.A.E. action agenda.

Objects 1 and 2 however, challenge the N.A.E. to do its own thing; 1. "To provide means of assessing the constantly

changing needs of the nation and the technical resources that can and should be applied to them; to sponsor programs aimed at meeting these needs; and to encourage such engineering research as may be advisable in the national interest." And 2. "To explore means for promoting cooperation in engineering in the United States and abroad, with a view to securing concentration on problems significant to society and encouraging research and development aimed at meeting them."

Here engineers can find the kind of elbow room they need to initiate programs relevant first to needs of the U.S. socio-economic system and second to the competencies of engineers working in harness with scientists and humanists. Self-elected projects will be hard core, concrete, and significantly important for the nation. They will be, as well, the kinds of projects on which engineering competence can make a respectable contribution.

More than a year ago, Dr. Walker asked N.A.E. members to reexamine the objects and purposes of the Academy; planning groups of the N.A.E. met all spring in small and plenary sessions. From this effort emerged a taut, forward-looking report containing dossiers on environmental control, international activities, and transportation. The report identifies priorities and proposes courses of action for the Academy.

A second new direction for the N.A.E. of the 1970's will derive from its changing interrelationships with the N.A.S. and its associated National Research Council. Precise new arrangements are not easy to discern now. Though not all engineers are enthusiastic about channeling their projects through the N.R.C. machinery, the N.R.C. route for N.A.E. projects is for the moment a workable compromise. Even those N.A.E. members who would prefer a more active role for themselves and the Academy recognize that they cannot shake loose the time from busy lives in industry, government, and the universities.

Whatever the ultimate relationship with the N.R.C., it can be stated almost absolutely that the N.A.E. will not separate

itself from the National Academy of Sciences. No matter what projects the engineers may put at the top of their action-priority list, all will impinge upon the sciences—physical, life, social. Under the arrangement with the N.A.S. as it stands today, free intellectual exchange exists between the Academies and between disciplines. Obviously, it is a healthy arrangement.

A third new direction involves resources. The N.A.E. is not a wealthy organization. The 280-member Academy enjoys an endowment of about \$500,000, while the 840-member N.A.S. is endowed in the amount of approximately \$20 million. The N.A.E. hopes to be able to shore up its bank account measurably. Already industry has given assurance of larger support. Furthermore, increased funds may well become available, either from government or industry or both, as the critical nature of N.A.E. programs in response to threats to national well-being becomes better understood.

The young academy of engineers is growing up from shy and diffident childhood into more confident youth, less dependent upon an older sibling. Its voice is changing. What it says is becoming more articulate, resonant, and self-assured—sounds of an inner-directed young man. If you listen, you can hear an expression of new-found freedom for the National Academy of Engineering.



Clyde C. Hall, formerly the Public Information Officer of the National Science Foundation, is a wise and experienced observer of the Washington scene.

BIOLOGICAL CONTROL SYSTEMS ANALYSIS

John H. Milsum, McGill University, Montreal, Canada. Electronic Sciences Series. 466 pages, \$17.50 | This book shows that many biological systems can be mathematically modelled, analyzed, and synthesized through the use of techniques developed in control engineering. Of particular interest is the material on maximum effort control, discrete and continuous statistics in systems, and adaptive and optimizing control. The use of computer modelling and solutions is emphasized. A number of problems extend the material.

PRINCIPLES AND APPLICATIONS OF ELECTROMAGNETIC FIELDS

Robert Plonsey and **Robert E. Collin**, both of Case Institute of Technology. 570 pages, \$15.00 | This is a thorough treatment of basic electromagnetic fundamentals with applications. Vector analysis is introduced with emphasis on physical interpretations. The topics covered include electrostatics, stationary current flow fields, magnetostatics, time varying fields and Maxwell's equations, the "separation of variables," and "conformal mapping" techniques for solving Laplace's equation.

SOLID STATE BIOPHYSICS:

**Applications of Electron Spin Resonance,
Dielectric Measurements, the Mossbauer Effect,
and Lasers to Biology and Medicine**

Edited by **Sidney J. Wyard**, Guy's Hospital Medical School, University of London. Advanced Physics Monograph Series. 384 pages, \$12.50 | This graduate-level text and reference book presents important, recent research findings and explores the future potential of each investigative method. Each section is written by a contributor working actively in the field. The material is easily comprehended by anyone who as an undergraduate degree in physics.

A SYSTEMS APPROACH TO BIOMEDICINE

William B. Blesser, Polytechnic Institute of Brooklyn. McGraw-Hill Series in Bioengineering. 544 pages, \$19.50 | Introduces engineering and mathematical concepts in the life sciences and demonstrates how they can be used in the study of living systems. The author utilizes pertinent clinical and physiological illustrative examples. A qualitative and verbal discussion of these examples precedes the introduction of quantitative ideas; contact with the real, physical world is thus maintained while abstract and numerical concepts are developed.



330 WEST 42ND STREET, NEW YORK, NEW YORK 10036

They Have Their Exits

The Dazzle of Things Past

The Bauhaus: Weimar, Dessau, Berlin, Chicago

Hans M. Wingler

Cambridge, Mass., The M.I.T. Press,
696 pp., \$55.00

Reviewed by

Rudolf Arnheim

Professor of the Psychology of Art
Harvard University

How can one do justice to this ten-pound giant of a book, except by praising its riches? Just to handle it physically one longs for one of those tilted wooden lecterns on which the Laurentian Library in Florence displays its venerable codices. The mental association thereby conjured up between the ancient classics and a book on a modern arts and crafts school is not entirely sacrilegious. During our lifetime, the Bauhaus has grown in our minds from a local institution, founded and directed by some of our more or less fallible contemporaries, into a symbolic embodiment of influential ideas, a solemn chapter of history.

What is it about the courageous little place, which had more than its share of political, economic, and personal trouble, that thus exalted it above the innumerable schools of similar scope throughout the world? Several factors are responsible, each powerful and essential and all profoundly different from one another. The unique manner in which these factors combined was not a perfect synthesis. In retrospect one sees that the very failure of the Bauhaus leaders to build the integrated structure they had envisaged gave the school its dramatic personality. Instead of a stable edifice it was a play of precariously balanced tensions, heaving through continuous crises, and frantically in need of all the incredible intelligence and imagination that struggled for survival in Weimar, in Dessau, in Berlin, and finally in Chicago.

The merit of this splendid volume, first published in a German edition of 1962, consists in its being a collection of verbal and pictorial documents. The author, Hans Maria Wingler, acts as commentator, supplying the needed facts *sotto voce* on the margin of the page, and lets

the excerpts from programmatic statements, official decrees, newspaper reports, recollections, and personal letters speak for themselves. Much of this material was totally unavailable before. Equally valuable and varied are the more than 800 illustrations, ranging from good color plates to faint snapshots and showing the products, the settings, the buildings, the students at work and at play, and the impressive faces of the masters.

Yes, the "masters"—as the teachers were called in accordance with the guild ideology of the early Bauhaus, until they gave in to the ways of the world and became professors. Has there ever before in history been a group of great artists joined together not as a mere company of friends or as a cooperative or workshop but as an academy organized to teach? An amateur photograph taken in 1926 on the roof of the studio building in Dessau looks almost mythological, like a Parnassus, when we realize that standing there together in hats and raincoats are Gropius, Klee, Kandinsky, Feininger, Albers, Moholy-Nagy, Breuer, Schlemmer, to mention only the most famous. If the Bauhaus had been nothing but an assembly of these generators of creative energy, each of them a world of images all his own, acting next to each other, with each other, against each other, its effect on the students would have been unparalleled. But the Bauhaus was more than that.

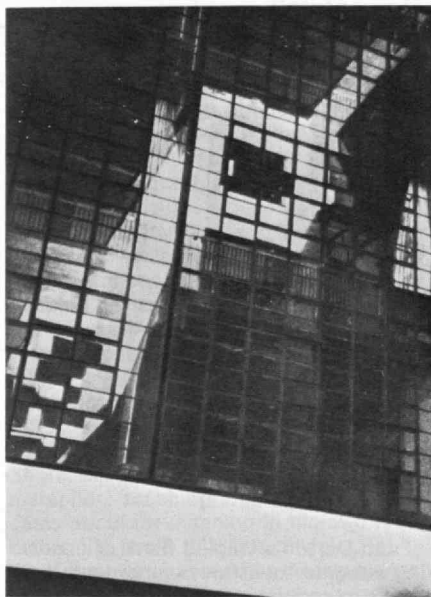
The times were ripe for a confrontation of the basic concepts, orientations, disciplines in the arts: pure form and functional form, fine arts and applied arts, handicraft and technology, specialization and integration. There was no way of solving within a few years those fundamental problems, which challenge us today as they did then. Even so, the Bauhaus approached them belligerently by experimenting with objectives and convictions that varied with the years, depending on who was in charge. Gropius, its first director, proclaimed that "the final goal of all formative activity [*bildnerische Tätigkeit*] is the building." This meant that the architects, painters, and sculptors, freed from their isolation, could revitalize their trades by cooperating in a functionally meaningful whole; also that the monastic drawing boards, easels, and

lumps of clay or marble were to be replaced by the materials and procedures of craftsmen, who worked for the site and on the site. This was the vision of an architect. In the eyes of painters like Klee or Schlemmer, the integration could also, and perhaps preferably, take the form of a purely aesthetic synthesis of all the media, e.g., of a stage performance, combining acting and dance, painting and sculpture, pigments, lights, and music. At the other extreme, a unitary approach could be obtained by brutal simplification. "All things in this world are the product of the formula: function times economy," wrote Hannes Meyer, the radical architect who governed the Bauhaus in 1928-30, "and all these things are therefore not works of art: all art is composition and hence unsuited to achieve goals; all life is function and therefore inartistic." At their best, these internal discrepancies, maximized by constant external pressure, worked against any premature crystallization of the system; at their worst, they led to hatred and destruction.

Another most significant problem of the period, amply illustrated in Wingler's book, was the relation of free to functional form. The nineteenth century had cluttered the objects of practical use, especially buildings and interior furnishings, with a growing burden of biomorphic ornament. The reaction, initiated by architects and designers such as Peter Behrens and Henry van de Velde, took two directions. It sought to reduce objects to the simplest shapes compatible with their functions, and it replaced the luxuriant foliage of the Art Nouveau with the more severe elements of geometry. The two trends did not always conform smoothly.

If we look with the eyes of 1970 at the bare walls of a Bauhaus bedroom designed in 1930, at the stark rectangularity of its furniture, rugs, and windows, we are chilled by their austerity. Not easily do we recall the sense of joyful liberation experienced half a century ago when the Bauhaus style began to whitewash our rooms and cleanse our eyes. We have ceased to be grateful for the fact that nowadays even the most unashamed motel decorator is unwittingly restrained by the demand for

Windows of the Bauhaus in Dessau. The building was designed by Walter Gropius in 1926. (Photo: Von Material zu Architektur, by Laszlo Moholy-Nagy, Mainz, F. Kupferberg, 1968)



plain texture, unobstructed straightness, clear color, which shocked and elated the Western world in the Bauhaus years.

Not that function really determined form. It soon became evident that this is not possible. At best, function can suggest that a prevailing style of design no longer suits its purpose. Function called for simplification, but it did not prescribe geometry. One need only examine the buildings, chairs, lamps, and other objects designed in the Bauhaus workshops to notice that some of them wear their cubic or spherical shapes as naturally as the human body wears the curves of its torso and limbs; but then again there are teapots and ashtrays as ostentatiously disguised with geometry as were the cubic and pyramidal robots on the stage of Oskar Schlemmer's Triadic Ballet. There was at the Bauhaus a somewhat uneasy confluence of functionalism and cubism.

One of the reasons why the Bauhaus favored geometrical shapes was that it was a school, dedicated to teaching and schematic diagrams. Although many of the members agreed with Gropius that "art cannot be taught," it was possible at least to define the elements and some of their combinations if form was reduced

to the products of the compass and the T-square. However, the borderline between a pictorial or sculptural composition and a diagram or working model was not always clear, and visual tidiness could lead to dogmatism. The shapes well suited for a chest of drawers did not necessarily make good sculpture. Even the mature art of Kandinsky and, to some extent, Klee shows the restrictive influence of this fundamentalism, and there can be little doubt that Bauhaus art was at its best when it exploited the expressive strength of its vocabulary quite freely or gave in to the play of fantasy and humor. However, the Bauhaus as a school was not after art per se. The common denominator of simple shapes enabled the students of architecture, design, and the fine arts to realize that buildings and toys, cubist sculpture and the cubic space of the theatre stage shared basic visual properties. It was at this level of formal kinship that the Bauhaus attained most successfully the unity of media and conceptions to which it aspired.

The Bauhaus survives with honors, not because it solved the aesthetic, functional, technological, and social problems of modern design, but because it posed them all with unequaled precision and presented them with a display of talent that continues to dazzle us. Opening Mr. Wingler's treasure chest at random, one finds anticipations of the eye-teasers of "optical" art next to samples of what looks now like computer art; one sees abstract compositions of moving lights, a Bach fugue translated into an architectural monument, stage sets by Kandinsky for Moussorgsky's musical poem "Pictures at an Exhibition," or the attractive ornaments of cut and folded papers that entertain the students of foundation courses up to this day in art schools all over the world. "The way the problem was posed," wrote one of Paul Klee's former students, reminiscing about his lectures on artistic design, "often sounded like the formula of a mathematician or physicist, but, considered carefully, it was pure poetry." This, I suppose, was the true secret of the Bauhaus.

Security before the Bar

The Oppenheimer Case: Security on Trial

Philip M. Stern

Harper and Row, 1969, 593 pp., \$10.00

Reviewed by

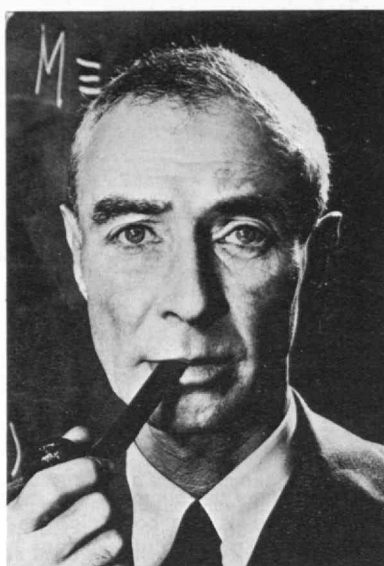
William A. Higinbotham, Head,
Instrumentation Section, Brookhaven
National Laboratory

The Second World War ended dramatically and suddenly with the atomic bombing of Hiroshima and Nagasaki. Although atomic scientists warned that the U.S. monopoly would not endure for long, public and government were anxious to bring the boys home and seized upon nuclear weapons as the easy way to counter the rising Communist threat. The attitudes of those times are reflected in the heavy emphasis placed on classification of information and on personnel security in the Atomic Energy Act of 1946.

William L. Borden, appointed by Senator McMahon to the staff of the Joint Committee on Atomic Energy, took an interest in these matters, and, after the Russian atomic test in 1949, he became concerned with expediting development of the hydrogen or fusion bomb. Shortly after leaving the Joint Committee in 1953, Borden wrote a letter to J. Edgar Hoover which said "that more probably than not, J. Robert Oppenheimer is an agent of the Soviet Union." Concern about loyalty was at its peak in 1953. Senator Joseph McCarthy had charged that the Army's Fort Monmouth Lab and the State Department were infiltrated by Communists. When the Borden letter was brought to President Eisenhower, he ordered that a "blank wall" be placed between Oppenheimer and classified information and instructed the Atomic Energy Commission to review his clearance. Although Oppenheimer's consulting appointment was soon to expire, the A.E.C. elected to present charges. After an exhaustive and exhausting hearing, the hearing board, the General Manager, and the A.E.C. voted to withhold clearance.

Whether Senator Hickenlooper believes it or not, Robert Oppenheimer was one of the great American theoretical physicists. Everyone agrees that he did an outstand-

In reviewing the most recent book on the history-making security case of J. Robert Oppenheimer, physicist William A. Higinbotham summarizes the importance of the issues raised by The Oppenheimer Case for our time: "... Very few, if any, spies have been turned up or turned out by the security system ... The problem is to design a security system that will do more good than harm, that is compatible with the fundamental principles that we would make secure." (Photo courtesy of Harper and Row.)



Edward Teller, Thomas K. Finletter, Admiral Lewis Strauss, and the others who wanted to discredit Oppie.

This is all very interesting, but the book goes further than that. In his preface, Stern says: "Initially, this book was to show how the Federal Government used its power to bring one man, J. Robert Oppenheimer, to his knees. But the more the story unfolded, the more the Oppenheimer case seemed to lay bare the vices of the security system itself and their malign effects on American society. ... In many respects the Oppenheimer affair offers the most graphic illustration of the (security) system's defects. ... Its voluminous transcript displays both the procedural injustices of the system and the extent to which security investigations often intrude into the most intimate details of a man's life. The origins of the Oppenheimer case ... demonstrate the system's susceptibility to being exploited for political (if not personal) ends. And the consequence of the case—the loss to the nation of Oppenheimer's talents and services—shows the costliness of the obsession with security."

Personnel security has been and still is a sticky business. Last winter it was revealed that the Department of Health, Education and Welfare still bars distinguished scientists from serving on unclassified review boards for security reasons—without notification or appeal procedure. Oppenheimer's review board found that he "had a high degree of discretion, reflecting an unusual ability to keep to himself vital secrets," which is, after all, what the security system is all about. Borden's charge that he was a spy was entirely refuted. But the majority of the review board and four out of five Commissioners found restoration of clearance to be in conflict with the security of the United States.

During the 25 years of the cold war, very few, if any, spies have been turned up or turned out by the security system. Yet as a result of that system, many scientists have had clearance troubles

and some have not been able to work at their profession for years at a time. Others, alas, have been afraid to associate with friends or to speak their minds in public.

It is one thing to argue that universities should not sponsor classified research. But unless one believes in unilateral disarmament he must face the problem that some vital secrets do exist and that some form of personnel clearance is necessary in military, diplomatic, and other areas. The problem is to design a security system that will do more good than harm, that is compatible with the fundamental principles that we would make secure.

Which to Value More: Man or Life?

The Unexpected Universe

Loren Eiseley
New York, Harcourt, Brace and World,
239 pp., 5.75

Reviewed by
Jeffrey Ingram
Associate Director,
Alumni Fund, M.I.T.

Loren Eiseley's *The Unexpected Universe* exists in the mists and darkness of the author's metaphor, reminiscences, and thought. The reader, led through the book largely by the sense of an older man's sadness, his agonies, and his feeling of separation, will also be led beyond the book by Eiseley's compelling insistence on fire and life.

"From Darwin's tangled bank of unceasing struggle, selfishness, and death had arisen, incomprehensibly, the thrower who loved not man, but life." The "thrower" is a man Eiseley noticed on a beach at low tide, rescuing starfish by throwing them back to sea—a human activity which is not comprehensible in Darwinian terms—much less as "man's conquest of nature." The first world, the natural one, and the second, which man conjured up out of nature, "exist on the planet in an increasingly uneven balance," in which man allows life in his own, second, world to have only the configurations he likes.

Yet "life is a furnace of concealed flame"; it is "the cell that had somehow mastered the secret of controlled energy, of surreptitious burning to a purpose, had finally produced the mind." And life, the cell, may go beyond man unless man can stop always forcing nature to retreat, and can come to value not man but life.

The Unexpected Universe is not a synthesis or popularization of science; it assumes some knowledge of the sciences and the readers' sympathy with them. Eiseley's prose is difficult reading; his logic is not linear; sometimes it is not even interconnected. If the reader is not to dismiss it as world-weary and wandering, he must be willing to extract the thought from Eiseley's stories and musings. In doing so, the reader will gain—in the midst of the current acceptance of

ing technical and administrative job as director of Los Alamos during the war. There are those who question his wisdom with regard to the use of the atomic bombs at the war's end, but not his sincerity. From his wartime discussions with Niels Bohr sprang the framework for the Acheson-Lilienthal report and the U.S. proposal of 1946 for international control of the atom (no subsequent arms control proposal has been nearly so inspired or farsighted). Oppie tried to work for a sane nuclear policy from within government while others, like myself, tried from outside. We did not always agree on what means were best, but there was always mutual respect and on his part great dedication combined with great wisdom.

The transcript of the Oppenheimer hearing, a thousand pages of fine print, was later published, together with the ancillary documents. Here was revealed the secret debate about the H-bomb, the several divergent viewpoints regarding U.S. military policy, and Oppie's casual but suspect contact with Communists (mostly colleagues and mostly before the war). Ironically, Oppenheimer had pleaded for more open debate of military and foreign policy in an article in *Foreign Affairs* in 1953. Sadly, the security files presented during the hearing were to cause embarrassment or worse to a number of his friends.

The nature of the hearing, the testimonies of witnesses, and the factors which the several judges considered to be relevant were fairly presented and analyzed in a book with a similar title by Boston lawyer Charles W. Curtis in 1955. Philip Stern was encouraged to restudy the case by Harold P. Green, who has long been interested in the security system and has written a penetrating analysis of the relationship between the A.E.C. and the Joint Congressional Committee on Atomic Energy. It also happens that Harold Green was the individual who drew up the list of charges against Oppenheimer for the A.E.C. in 1954. By careful research, Mr. Stern has managed to fill in much of the relevant background regarding Oppie's early career and associations, the war years, and, more significantly, the misunderstandings and mistrust of William Borden, David Griggs,

the need to protect the environment as a matter of national priority—a chance at a compelling philosophic basis for that priority. The public now lacks such a basis; it also lacks a common yardstick by which to measure the various enunciations of the environment cause. This Eiseley's outlook certainly offers.

Our present wallowing in doomsday rhetoric about man's destruction of his world removes the risk that, in stating Eiseley's point, one will appear overdramatic. He knows that "the secret was to travel always in the first world," the natural world, and not to be overpowered by the visions our brains have created. Until man can bridle the results of his image-making, then concern for our environment can only be a clean-up, fix-up, paint-over campaign in a steadily deteriorating evolutionary ghetto.

This message recurs often in the book, but what obscures it, and confounds hope, is the persistent distress of the author. While his despair is doubtless partly autobiographical, it also intertwines with unease over the general situation of man. It appears in anecdotes from his own life, fragments of the human story, contemplations sustained by the work of Darwin, Thoreau, and Captain Cook—all smudged and blended by a vocabulary dominated by ghosts, desolation, and things unexpected, hidden, angry, indeterminate, invisible, innocent, terrible, dim, and unsightly.

This vocabulary is formed into powerful metaphors reaching a peak as Eiseley casts about for meaning in his own life and in life itself. "All this devious, tattered way was exposed to the ceaselessly turning eye within the skull that lay hidden upon the bed in Costabel. I know only that I was the skull of emptiness and the endlessly revolving light without pity." Here Eiseley is, as man always is, "a creature who dreams outside of nature, but is at the same time imprisoned within reality." At length, thought, mediated by that eye, closed the rift; Eiseley comes back inside nature and goes out on to the beach at Costabel to find, and be, "the thrower who loved not man, but life."

The Unexpected Universe, appropriately, like evolution, has no structure; it is all shift and flow. It is a scornful book, for, though often agonized, Eiseley returns again and again to his certainty that "everything is in the flowing," and man is important only because he can make an end—not just to another nation, or to his own species, or even to this planet—but to life.

And, it must be added, the book must be scorned by those who see as a triumph of wit our steadily increasing population, our use of nuclear weapons, and our coming control of heredity.

Evil Communications...

Counterblast

Marshall McLuhan (designed by Harley Parker)
Harcourt, Brace & World, 143 pp., \$6.50

Reviewed by Fred Wheeler

The theatrical production *Hair* (which has now come to Boston) is billed as a "tribal love-rock musical." This use of the word "tribal" derives neither from anthropology nor from the vocabulary of the people whom *Hair* is alleged to portray. It derives from the work of Professor McLuhan, who is thus seen to be not without influence—at least, verbal influence.

At first sight, McLuhan's career as a sage resembles that of a second-rank rock star—from obscurity to oblivion in about four years, via the heights. But he is not yet entirely out of the public eye. He is satirized in the film *Putney Swope*. His "multimedia" newsletter *The Marshall McLuhan Dewline* acquired 4,000 paying readers in its first year (1968-69), at an annual subscription of \$50, and made a profit in that time. This information is provided by the publishers, the Human Development Corporation, New York, who are also responsible for the *Stay Young Newsletter* and *The Alan Watts Journal*.

Counterblast is so named by some kind of analogy with Wyndham Lewis' *Blast*, the magazine of the now all-but-forgotten Vorticist movement (1914). In his preface, McLuhan seems to be saying that in order to perceive objectively the effects of a given environment one must observe them from a different environment, and that this book is an attempt to provide such a "counter-environment." He is, it would seem, offering to give us the power to see ourselves as others see us.

In fact, the book is an interlarding of the old tried and distrusted McLuhan prose with far-out typography and graphics. The latter are the responsibility of another Canadian, Harley Parker, who introduces himself with the words, "Good taste is the first refuge of the witless." This mock-epigram has plainly been synthesized by substitution from Dr. Johnson's "Patriotism is the last refuge of a scoundrel"—a technique which, later in the book, we find inflicted also upon the sad truth that "the English can never remember and the Irish can never forget," with absurd results. We perceive that one of McLuhan's heroes is James Joyce—perhaps because Joyce succeeded in writing a book that became world-famous without being comprehensible.

It might help if McLuhan employed, in addition to a designer, a ghost-writer. Reading the words might then become as easy and pleasant as gazing at the visual outbursts, and even—who knows?—more instructive. As it is, the best guide to what he actually means is probably Tom Wolfe's article, "What If He Is Right?" in *The Pump House Gang*. The central idea

is that any medium of communication has profound effects on people and on societies, as a result of its inherent filtering properties and of its tendency to induce reliance on particular senses. Thus, contemporary Western youth is supposed to have become "tribal" because their communication is primarily through sounds and images, as in illiterate societies, rather than through the printed word.

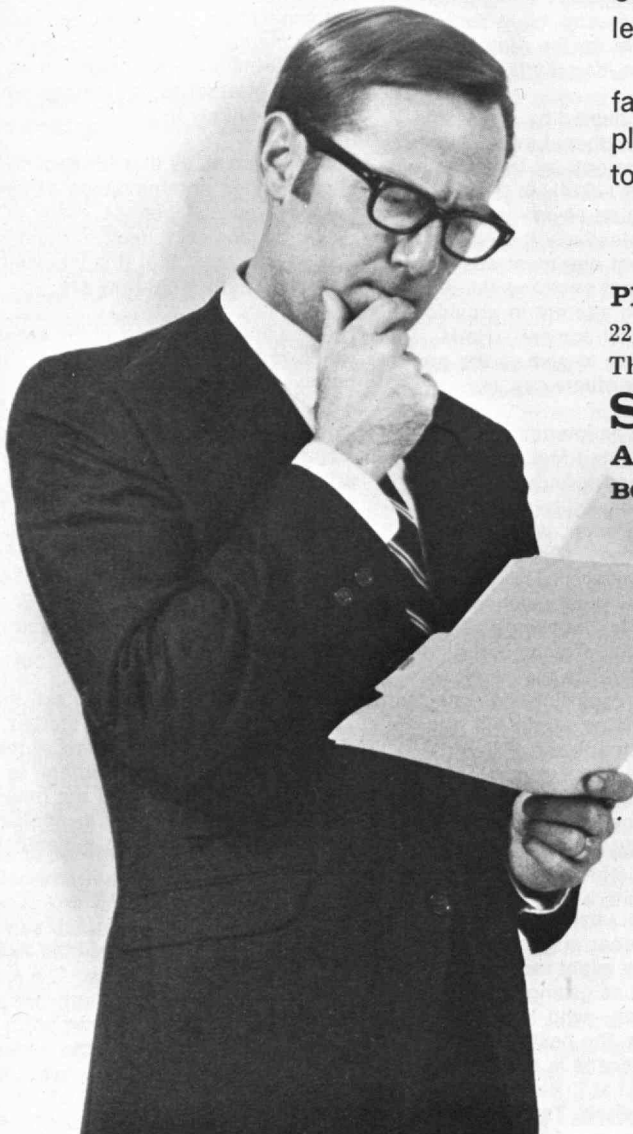
Clearly enough, the advent of printing was a major influence in the formation of our civilization. If, now, current changes in our means of communication are going to be of similar consequence, it would be of some interest to understand what their effects are likely to be.

McLuhan takes us that far and no farther. He generates an abundance of hypotheses and allegations, many of them evidently incorrect, most of them so badly formulated that it is impossible to be sure exactly what they are.

He also identifies some of the areas which require serious research: the successive alterations of content which a work of fiction is compelled to undergo when it is in turn adapted from book to stage to cinema to TV; the apparent disappearance, in the use of the new media, of the traditional subject-classifications; in politics, the differences that radio and now TV have made to the business of impressing an electorate; and the "political and social impact of radio and TV technology on peoples who have had neither book nor press."

But to judge from *Counterblast*, the research has not even been started. It is as if, having become convinced of the usefulness of the atomic approach to chemistry, Dalton had devoted the remainder of his life to refining the symbolism and making up likely-looking molecules out of his head.

How can the serious investor outpace inflation— or even hedge against it?



It is true that common stocks do offer an opportunity to hedge against inflation. But it is an opportunity with definite conditions attached.

The job of investing wisely has become more and more complex—and not only for reasons of inflation. American industry is undergoing a period of immense change. Every business day brings news of corporate weddings and engagements, of proposals rejected or withdrawn.

The services of our Personal Trust Division reflect these changing times. An increasing and important phase of our responsibilities is now the management of investment portfolios during the owner's lifetime. Sometimes we serve as trustee under a revocable living trust agreement. Often we act as agent, under a simple letter of instructions.

If you would like to become more familiar with our here-and-now trust services, please phone 466-3721 for an appointment to suit your convenience.

PERSONAL TRUST DIVISION

225 Franklin Street

Third Floor, State Street Bank Building

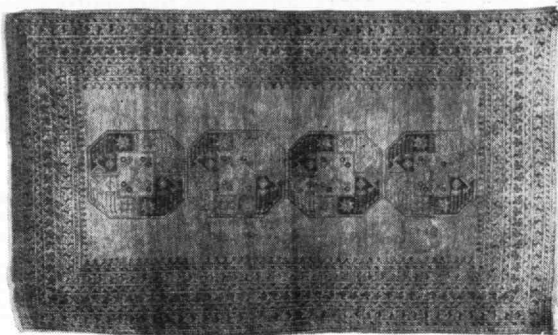
STATE STREET BANK

AND TRUST COMPANY

BOSTON, MASS.

Antique Afghan 4.4 x 7.6 \$575

One of hundreds of fine antique Afghans now in stock.
All sizes; colors mostly rust, orange-rust, and brown.
Also an immense collection of new natural gold Afghans.



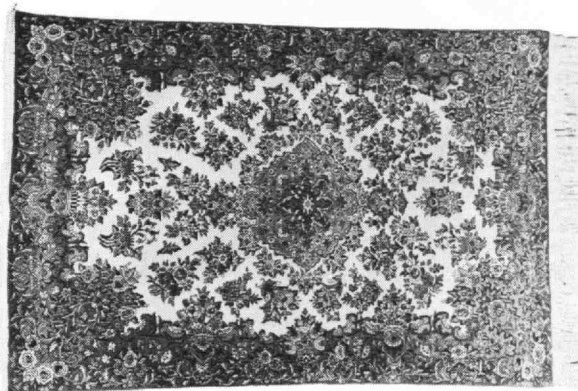
Meshkin

6 x 9.10
\$1275
Woven by the descendants of Caucasian weavers. Striking use of colors like gold, green, yellow, brown, blue and tan. Most sizes available, 8 x 10 and under.

Isfahan Hunting Rug

3.5 x 5.6
\$2575

One of the finest rugs to come out of Isfahan in recent times. Its design is drawn as sharply as though it were done by the pen of a miniature painter on parchment. It reproduces a hunting scene with Bahram Gur, famous Persian king and huntsman.



Qum 4.5 x 7 \$590

Influenced by Keshan and Kirman weaving. A prize example of the art of Qum weaving from Iran's holy city. The field is ivory with secondary colors of russet red and turquoise.

3,000 and 1 rugs.

Just send us your requirements. In addition to some of the finest Oriental rugs you'll ever find, we make it simple for you to select and price them. First, all rugs are personally hand-selected in Persia, Turkey and Afghanistan. Secondly, Arthur T. Gregorian has written the most definitive book of its kind — "Oriental Rugs and the Stories They Tell". Sixty two color plates, \$14.50 postpaid. Third, our new fall catalog is fresh off the press. You can get that simply by asking for it, together with our new price list.

And you can choose from Persian, Turkish, Afghan (Turkman) and Caucasian rugs, as well as rare antique Orientals purchased from estates. More than 3,000 rugs in all, and most of them on approval.

Then, this is our 35th Anniversary. It's one year-long sale. Write for our literature today. Or phone us collect.



Arthur T.
Gregorian inc.

2284 Washington Street, Newton Lower Falls,
Massachusetts 02162
(617) 244-2553



An optimal system of health care must reflect consumer preferences, must provide professional freedom and responsibility, must have a firm scientific base, and must be closely articulated to national health goals. None of the three national models—Russian, British, U.S.—meets all of these criteria; each offers lessons for the other two

Dr. Alonzo S. Yerby
Head of the Department of Health Services
Administration
Harvard School of Public Health

Health Care Systems—Some International Comparisons

Health systems, like other human service institutions, are products of social and technical forces. The major determinants of a national health system are consumer expectation and demand; the quality, quantity, and perceived roles of health workers; the body of laws regulating health practices, services, and manpower; the available scientific and technological base; the political climate and structure; and the nature and source of financing. Given a reasonable knowledge of these six determinants, it is possible to predict to some degree the nature and form of any national health system.

As an administrator I tend to view national health systems as analytic models. I am particularly interested in the internal and external constraints on health systems, since they have a certain predictive value and—perhaps more important—since they may lead to the identification of leverage points for improving effectiveness and efficiency.

National health systems may be classified according to such attributes as the locus of system level, decision making, and planning; the degree to which the system reflects expressed national policies; the existence of articulated goals for the system; and the availability of manpower, technology, facilities, and basic and applied research. This classification scheme reflects the administrator's view of the world. The consumer is more likely to be concerned with how he may make use of the system, to what extent it meets his perceived needs, and at what cost in time, money, and personal inconvenience.

For this discussion, I have chosen as locus one of the consumer's concerns—how he makes use of the system. In an effort to achieve comparability I shall limit the discussion to one aspect of consumer interaction with the system—that of entry point. How does the consumer get into the system? I shall not attempt to deal with effectiveness or real costs, since such a discussion would require a detailed description of measures and methodology.

Centralization, Decentralization, and Pluralism

I have chosen the health care systems of the Soviet Union, Great Britain, and the United States for this comparative discussion. Briefly, the health care systems of these three countries may be characterized as follows:

The Soviet Union provides a state-run system of health care which is integrated through centralized planning and direction with a significant degree of administrative decentralization to the 15 Union Republics and 20 Autonomous Republics. The planning and production of manpower, facilities, and services are functions of a single branch of government—the Ministry of Health of the Soviet Union and of counterpart ministries at the republic level. Preventive and curative services are integrated. Manpower, facilities, and services are financed out of general tax revenues and—except for changes for certain drugs and dental services—care is provided without direct charge to the consumer.

Great Britain, through its National Health Service, provides a system of health services which is financed largely out of general tax revenue (plus a small premium charge). Health services and facilities are the responsibility of the Ministry of Health. The production of health manpower is financed primarily from Exchequer funds allocated by a national University Grants Committee. While overall responsibility for health services rests with the Ministry of Health, planning and administration is shared by the Ministry with three types of administrative bodies. Hospital and specialists' consultation services are the responsibility of regional hospital boards; general practitioner, dental, pharmaceutical, and optical services are the responsibility of local executive councils; and paramedical services (bedside nursing, midwifery, medical social work, physical therapy, homemakers, ambulance transportation, etc.), custodial care institutions, and conventional public health services are the responsibility of local (health) authorities. In addition, university teaching hospitals are responsible to boards of governors which bypass the regional hospital boards and answer directly to the Ministry of Health. The consumer pays directly for certain forms of dental care and for eyeglasses, and from time to time deterrent charges have been levied on prescription drugs.

Health care services in the United States may be characterized as pluralism with a complicated admixture of governmental (federal, state, and local) and private responsibility. Much of private care is provided by independent practitioners and in nonprofit hospitals or clinics, although a significant amount is provided by profit-making institutions. Roughly speaking, preventive health services are the responsibility of local govern-

ment; mental and chronic hospital services are the responsibility of state government; general hospital services are provided by nonprofit corporations; physician services are provided by individual practitioners or medical groups (group practices or medical partnerships); drugs, optical goods, and prostheses are available through a combination of wholesale manufacturers and retail dispensing outlets. Ambulance services may be provided by private companies, local government, or voluntary community programs—or mixtures of all three. Regulations and standards vary widely. Over 70 per cent of health services are financed from private sources. Approximately one-third of all private expenditures are paid by health insurance. Seventy-five per cent of the cost of health facilities are private expenditures with the remainder derived from tax revenues.

Though health care in the United States has been called a "nonsystem," technically this is not true. Health care in the United States is provided through a multiplicity of formal and informal systems which tend to cater to separate and distinct socio-economic population groups whose claim to care is determined by income, occupation, age, sex, public dependence, physical location, nature of health problem, and insurance status.

With these very brief descriptions of health services in the Soviet Union, Great Britain, and the United States, let us consider (in the language of today) how the consumer confronts the health system in his respective country.

U.S.S.R.: Polyclinics, Hospitals, and Feldschers

The Soviet citizen in urban areas is in fact confronted by several subsystems of health care. Adults are expected to obtain routine medical services (preventive and curative) from the polyclinic which serves the district in which he lives. Here he will be assigned to a physician who covers his immediate neighborhood. This physician is not a general practitioner in the usual sense, having been trained primarily in adult medicine—he is called a therapist. He may visit his physician at the polyclinic or request a home visit. At times he will be seen by a substitute physician when his physician is off duty. Women of childbearing age and children are generally seen in separate polyclinics for mothers and children. Physicians in these polyclinics are trained in pediatrics and obstetrics. In addition to general medical services, polyclinics provide specialist consultation and clinical laboratories, radiology, and physical therapy.

In many instances, workers (male and female) may have available a polyclinic at their place of employment. In this case the individual has the option of visiting the district polyclinic or the industrial polyclinic; however, home visits are not made by the physicians from the industrial polyclinic.

Hospitalization for most medical or surgical problems is in the general hospital serving the region. In most instances separate hospitals or separate wings of general hospitals are reserved for women and children. Many industries, particularly heavy industries, maintain their own general hospitals, and their workers who have elected to enter the system through the industrial poly-

clinic are usually hospitalized in the industrial hospitals. Separate hospitals are maintained for patients with tuberculosis or mental illness. In respect to the mentally ill, most remain in the community or live in special colonies; relatively few are in mental hospitals. Highly specialized services such as cardiac surgery or neurosurgery are provided in medical center hospitals which serve large areas or large population groups.

In emergencies an ambulance may be called by dialing two digits on any telephone. There is no toll charge for such calls. Ambulance services are regionalized and in urban areas are dispatched within minutes of the receipt of the telephone call. Ambulances are specialized in that the ambulance attendants and the equipment are organized according to the nature of the emergency. Heart, psychiatric, and shock cases are transported in special vehicles equipped so that a diagnosis can be made and definitive therapy provided en route to the hospital. These ambulances are manned by specially trained physicians.

In rural areas and on many farms, the individual enters the health care system by visiting a health station manned by a paramedical worker (*feldscher*) and a midwife. Home visits are made by the *feldschers* and midwives when required. Serious cases may be referred to district hospitals or, if nonemergency, may be asked to return to the health station on the day on which the district physician will be present. Ambulances, including aircraft, are available to transport patients from remote areas to district hospitals or urban medical centers. In summary, then, the Soviet citizen enters the system through a district or industrial polyclinic or through a *feldscher* station. Home visiting is available and ambulance transportation to hospitals is used for persons with serious illnesses or injuries.

Britain: General Practitioners

In Great Britain all adult individuals or families are expected to enroll with a general practitioner. While general practitioners are not required to limit their practices to particular neighborhoods, there is a natural tendency on the part of physicians and consumers to minimize travel and waiting by keeping within reasonable geographic boundaries. The general practitioner is essential; except in emergencies, hospital or hospital outpatient services are not available unless the patient has been referred by a general practitioner, and specialist consultation must be requested by a general physician.

Basically, there are only two points of entry for medical services—the general practitioner or the emergency service of a hospital. Nonemergency cases reporting to a hospital emergency service will be seen and usually referred to their general practitioner or to the hospital outpatient service. Ambulance service is available for transport of the seriously ill or injured, and in large urban areas specially equipped ambulances are available for certain types of cases. Ambulance service is centrally administered as in the U.S.S.R. and deployed on a district basis to minimize travel time.

Unlike the Soviet Union, preventive services are not integrated with curative services; they are available from

local health departments or, for school-age children, from the school health services. Persons requiring diagnostic or therapeutic services are referred to general practitioners or hospitals.

The British health system may be characterized by its organization around the general practitioner as a personal physician for everyone and as the first contact source for the bulk of medical care. Hospital care is regionalized for both somatic and mental illness. The national plan for the construction of future hospitals emphasizes the general hospital, and special hospitals are to be phased out.

Both Britain and the Soviet Union have attempted to make a health professional available to the entire population. Russia has used compulsion and economic incentives in an effort to provide physicians to nonurban areas, and there is a continuing reliance on paramedical personnel, particularly in rural districts. Britain has used economic incentives and restrictions against physicians setting up practices where there are adequate numbers of doctors to assure the availability of medical services in rural and unattractive urban communities.

U.S.: Incoherent Multiplicity

The consumer in the United States is confronted with an "open" system or a multiplicity of formal and informal systems. He may be eligible for care from several systems (public health, school health, prepaid group practice, veteran's health service) at the same time, or he may be eligible for care from no organized system. He may be eligible for some forms of care from one system and not from others; for example, a school child may be eligible for dental but not for medical care from the school health service. In general, there are few incentives for consumers to secure personal physicians, and surveys have shown that many people do not do so. This may be a matter of personal choice, or—particularly in rural areas, small towns, or urban slums—it may be due to lack of money or the unavailability of a doctor.

The prevailing pattern of solo practice of medicine in the United States presents increasing problems to both patient and practitioner as specialization and the use of complex technology increases. In order to meet the needs of their patients, general practitioners often refer to specialists, and specialists often refer to other specialists. Laboratory, physical therapy, radiology, and other services are typically organized independently, and delays, inconvenience, and expense are often experienced when these are not available under one roof or even in one immediate area. Group or hospital-based medical practice has proved to be one method of improving efficiency and coordination of care.

Ambulance services are generally available through private companies. Some municipalities operate ambulances, and in rural areas there are voluntary ambulance corps except where ambulance service is provided by private undertakers, usually for a fee; in these instances persons who are unable to pay have no service. Few cities have a centralized dispatch system covering all ambulances, public or private. Moreover, private hospitals have the right to decide whether or not

they will serve as receiving hospitals.

Unlike Britain or Russia, where all hospital physicians are specialists, hospitals in the United States may be staffed only by general practitioners or specialists or by combinations of both. Some have effective safeguards—and regulation with respect to the scope of medical staff activity, while others have minimal safeguards—or none at all. The situation for mental hospitals and nursing homes is even more variable.

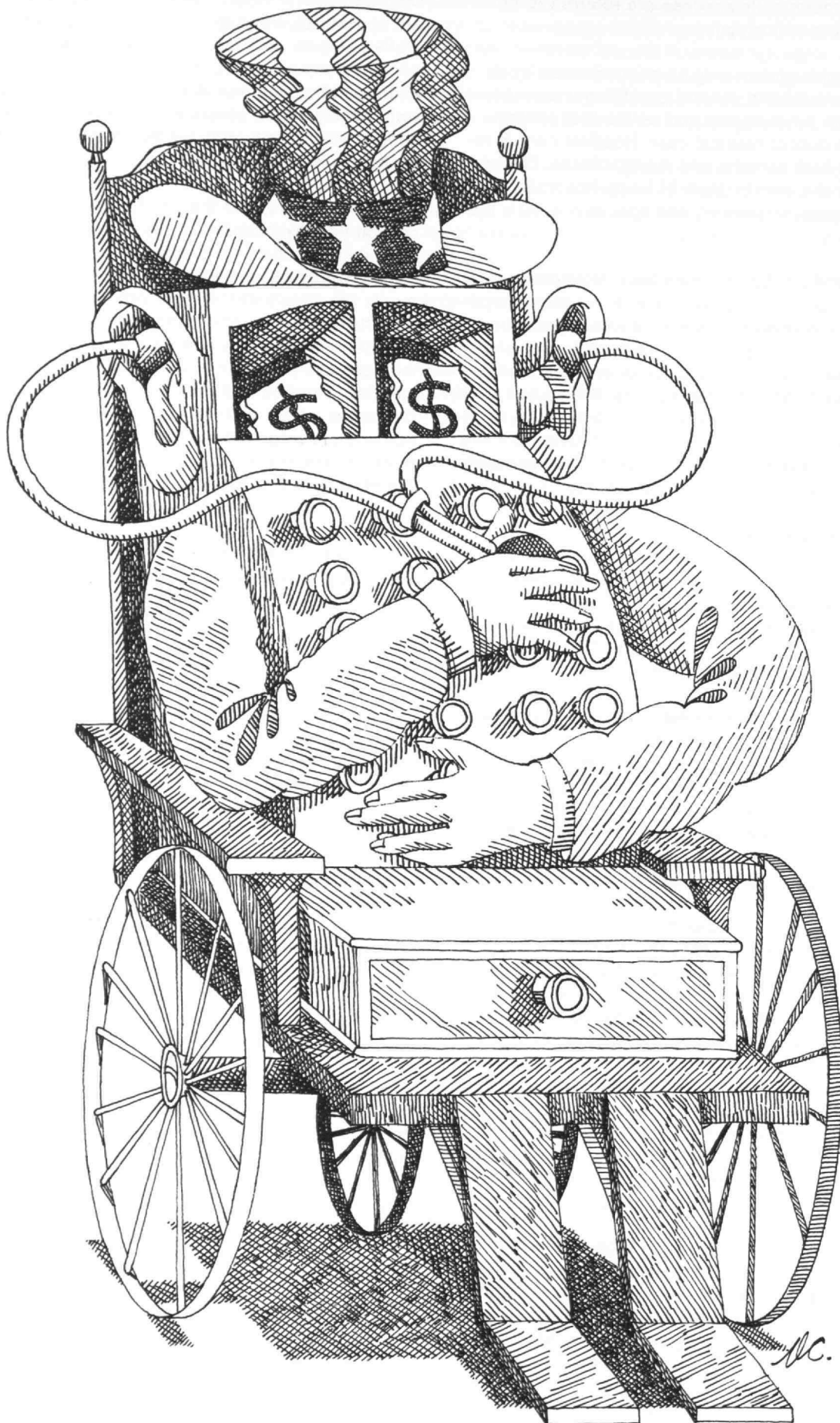
In Britain, Russia, and the United States consumers may consult nonphysicians, such as pharmacists or even nonmedical healers or quacks. Some programs in the United States will pay for services by any individual who meets the state's definition of practitioners of the healing arts—including chiropractors, naturopaths, and faith healers. Moreover, the cost of physicians' care may lead the poor and people in modest circumstances to select marginal practitioners who charge lower fees and often guarantee cures. In Britain and Russia there is an economic discouragement to consult all such secondary, quasimedical practitioners, since these sources of care are not a benefit in the health system.

In the United States the production, distribution, and availability of health manpower reflects no coherent national policy; it responds primarily to the protectionist tendencies of the health professions.

In short, our "system" of health care reflects our pluralism and our distrust of government and of planning. On the positive side, our open system has encouraged innovation and experimentation. As a result we have been free to explore many patterns of health care organization and financing and to discard old ones when more effective and efficient ways were found. Group practice (with and without prepayment) and neighborhood health centers are current examples of innovative methods of organizing health services. Perhaps our greatest achievement has been in the quality and variety of biomedical research and the impressive number of university-affiliated medical centers where standards of research and medical care are unsurpassed. Our multiple systems give us the opportunity to test different patterns for first-contact medical care and perhaps to improve on the Russian *feldscher* or the British general practitioner as the entry point.

Slowly we are fashioning approaches for planning health services. Increasingly sophisticated technology will probably force us to achieve better coordination and communication between and among our multiple health systems and so enhance their effectiveness—even though we fail to enunciate a coherent public policy in respect to the organization of health services.

Before taking his present post at Harvard, where he is also Assistant Dean for Community Affairs, Dr. Alonzo S. Yerby was for four years Commissioner of Hospitals for the City of New York; earlier he was Executive Director of the Medical Care Service in the New York City Health Department and Deputy Commissioner for Medical Affairs of the New York State Department of Social Welfare. He was a member of President Johnson's Commission on Health Manpower.



The U.S. has a complex of interdependent health care programs, in consequence of which the amount and quality of his medical care is a function of an individual's income and his social position. The author proposes an alternative which will make health a truly national responsibility

Rashi Fein
Professor of the Economics of Medicine
Center for Community Health and Medical Care
Harvard University

Financing U.S. Medical Care

When we consider any single aspect of health care in the U.S.—such as its costs and their financing—we must begin by recognizing that we are indeed discussing a health care system, albeit highly fragmented, inefficient, and responsive to market forces, though we feel it should not be governed by those kinds of forces; and we must recognize that changes in one part of the system without changes in other parts may defeat the stated purpose.

Yet it is also true that we are not likely to change all components of the U.S. health care system at any one time. We will modify it in bits and pieces, pushing forward a little on one front and then a little on some other. How, then, to reconcile my two statements: that everything is interrelated, and that we cannot (or will not) change everything at the same time.

The answer lies in part in recognizing that change in one area, say finance, is in fact not going to accomplish as much as one would like. That in itself is not sufficient reason to reject a change which may have merits; the answer must also involve a recognition that change in one area should not have side effects that inhibit other changes, that at worst it must be neutral regarding other parts of the system and at best it must help induce changes elsewhere.

Yet, in the financing of medical care I do not feel that evolution is desirable or necessary; I am not even sure that it is possible. It seems to me that what is required is a radical departure from the present pattern of financing care—radical in the sense that expansion of existing programs will *not* provide a solution to the financing problem. Our hope does *not* lie in an expansion of the Medicaid budget, in a proliferation of neighborhood health centers sponsored under the poverty program, or even in combinations of these and other programs. What is required is something new and different, something that meets the problem and that at the same time meets criteria involving efficiency and equity.

What is the problem, what are the criteria, what can we design to meet the need?

The Unsupportable Right to Medical Care

Perhaps the most general way of stating the dilemma in which we find ourselves is that as a nation and as a society we have felt—and in recent years have stated explicitly—that medical care is a right, that its distribution

to individuals should not depend upon their economic circumstances. Yet we have not really faced up to the implications of that statement; we have not said that if medical care is a right, someone must therefore be responsible to see that medical care is available to all parts of the population, available in the sense that the services are there to be purchased at a price that people can afford to pay.

A right to what quality of care? A right to what amenities that accompany care? A right to how short a waiting period in a physician's office? Available how close to the person's residence? Available in what quantity? What is the price that persons can afford? To these questions we have no universal answers. Yet, I think few would disagree today that, whatever the specific definitions we might develop, we are not in fact now doing the job that we have implied to the American people is to be done.

The analogy with education is illuminating. Here government has also articulated a right. Here, also, there are immense delivery problems, and it would be foolish to brush them aside. The quality of education does differ nationally and between the inner city and the more affluent suburb. Economic circumstances still do make a difference. Yet, though none of us would claim that the job we are doing is being done as well as it should or could be done, in education when government articulates the right it also assumes a responsibility—to see to it that the teachers are there, that the school building is there, that certain standards are maintained. If government falls short of doing the job it should be doing, it is held responsible. We know where to take our complaints.

But there is no complaint address in health. Government has said there is a right; but if there are few physicians in an area, if the care is unavailable or the price beyond the reach of the individual or family, one does not complain to government; if he does, he learns that the delivery system is not really government's responsibility. Nor can one complain to the medical society, to the insurance carriers, to the medical school, to the local physician. Medical care is a right, and yet it is no one's responsibility. Yet that is a contradiction; one only articulates a right about important things and only under two conditions—when one is afraid that without articulation the right might be infringed upon

(for example, the right of free speech), or where one is not certain that the market can insure that without articulation everyone will get his fair share (for example, the right to education, to equal opportunity). If the goods can surely be delivered, so to speak, then there is no need to articulate a right to them. But if there is danger that the goods cannot be delivered, then that means that someone must work to assure their arrival.

It would be misleading to imply that government has done nothing to help solve the nation's health problems, to make medical care more available, to increase the quantity of health services or raise their quality, or to help pay for the costs. It has sponsored needed research. It has aided medical schools and schools for other health workers. It has helped build hospitals. It has provided funds to deliver services on a more organized basis to some individuals in certain population groups. It has developed Medicare for those over 65 years of age. It has provided federal money to interested states to assist in the purchase of services by certain categories of the poor.

Is the problem, then, that government has not put enough dollars into the programs it helps sponsor or helps pay for? Are we headed in the right direction but moving too slowly? Or is the problem more fundamental?

I believe the latter is true. I do not believe that expansion of existing programs will provide an efficient or equitable solution to the medical care delivery problem. Why? What is missing?

Obviously, though we agree that there is a highly inter-related system and that one cannot ignore the other parts as one considers changes in one part of the medical care system, I cannot discuss everything and every implication. I focus on the financing mechanism.

The Frustrations in Finance

To answer the question of what is missing from present financing mechanisms, let me present some of the characteristics that I believe they should encompass. I focus in largest measure on the financing problems of that part of the population that is poor, but I would note two things: the near-poor face problems in financing medical care that are not different in substance from that part of the population that falls below the official

poverty line (put differently, if we are concerned about ability to pay for medical services, the poverty line should be substantially higher); and the problems that middle-income and a good many upper-income families face in paying for medical care are not inconsequential. Many of us are, potentially, at least, medically indigent. So, though my focus will be on the poor, I do not propose to ignore the problems that others have. Indeed, I shall conclude that we should develop a single system of payment, one that covers the needs of all income groups.

The development of a desirable and effective financing mechanism which generates more demand for medical services on the part of the public, and which provides the mechanism for payment for these services, is by itself unlikely to solve the medical care needs of America. Increasing the dollars available for the purchase of medical care by the poor will assist them to obtain more medical care; but problems of access and problems of organization and distribution of medical services will remain to be solved. Indeed, if measures to solve the financing problem are undertaken in the absence of programs to increase the total supply of services available and to alter the characteristics of the medical market place, the ghetto population will continue to find itself in a weak competitive position, vis-a-vis suburbanites, and will continue to receive an inadequate share of the medical care available to the total community.

The suburban population—though it does not have greener dollars—has more resources, more education, easier access to physicians. It is more in tune with the physician's culture, and its problems appear more tractable and less frustrating. In a word, it is more middle-class. In a competition for scarce resources, in a market organized (or disorganized) along current prevailing patterns, and in a situation where no group or organization assumes the responsibility for the actual provision of care, medical care services will flow to those who are in the strongest competitive position—to those who live outside the ghetto. It is, therefore, essential that a better financing mechanism be coupled with an improved distribution system and with the development of better organizational patterns. We must work on both fronts.

Even with the development of better organizational patterns and improved distribution systems, the poverty



population will be unable to finance adequate amounts of medical care out of its own resources. Improvements in the organization and distribution of medical care would not increase the productivity of health personnel sufficiently to so reduce the price of medical care services that poor people could finance the purchase of such services in adequate amounts out of their own incomes. Medical care is expensive, and it is not going to become cheap. Thus, if people are to be able to obtain care, there will have to be some redistribution with dollars of the upper-income groups paying for medical care of lower-income groups. This is fundamental.

A number of alternative patterns for financing care have already been tried and, regrettably, have been found wanting or are not likely to be generalizable across America. Let us briefly examine two of these: neighborhood health centers and Medicaid.

One could hope and press for an increase in the number of neighborhood health centers supported by the federal government and in the dollars available for such endeavors. It would seem to me, however, that the likely

cost of a program large enough to make adequate medical care services available to *all* of the ghetto population is not likely to be enacted. We are more likely to fund such endeavors at a level that provides inadequate amounts of care for all or, alternatively, adequate amounts only for some. Furthermore, even if the funding began at an adequate level, there would be the inevitable temptation to cut back on the dollars and thus on the services available or on the population to be served in times of tight budgets. Furthermore, in a *national* program there would be major questions of eligibility and it would become increasingly difficult to determine whether a person was or was not eligible on the basis of residence alone. We would be led to means tests, income criteria, and investigations that most if not all of us find distasteful.

None of this means that I am opposed to an expansion of neighborhood health centers even as they exist and are financed today. Rather, I am saying that the concept of the neighborhood health center might grow much more rapidly if we could consider the center as a mechanism for the delivery of services, separating it from the

present mechanism of financing the center itself. If health centers are to spread, we should envision the neighborhood health center as something which government helps create and the development of which it helps stimulate, but whose operation is financed not by a specific appropriation but in some alternative manner.

The existing Medicaid program, the program that was supposed to eliminate charity medical care but which even at best has only eliminated some charity financing of medical care, has built-in deficiencies that are not likely to be overcome. It is and is likely to remain underfunded. It is coupled to a welfare system which is itself both crippled and crippling. It is subject to charges of abuse by the recipient and provider. It is based on a fallacious assumption that the present system for delivery of care is adequate. It is not designed to encourage change.

Toward National Health Insurance

As a result of existing inadequacies in financing mechanisms, a number of alternatives have been suggested. One such proposal, and the one that I favor, would treat all individuals on the same basis and would permit the development of model systems of delivery whose operations would be financed out of the funds provided for the purchase of medical care services, i.e. the funds provided for in this proposal. In a word, I favor and advocate a national health insurance program.

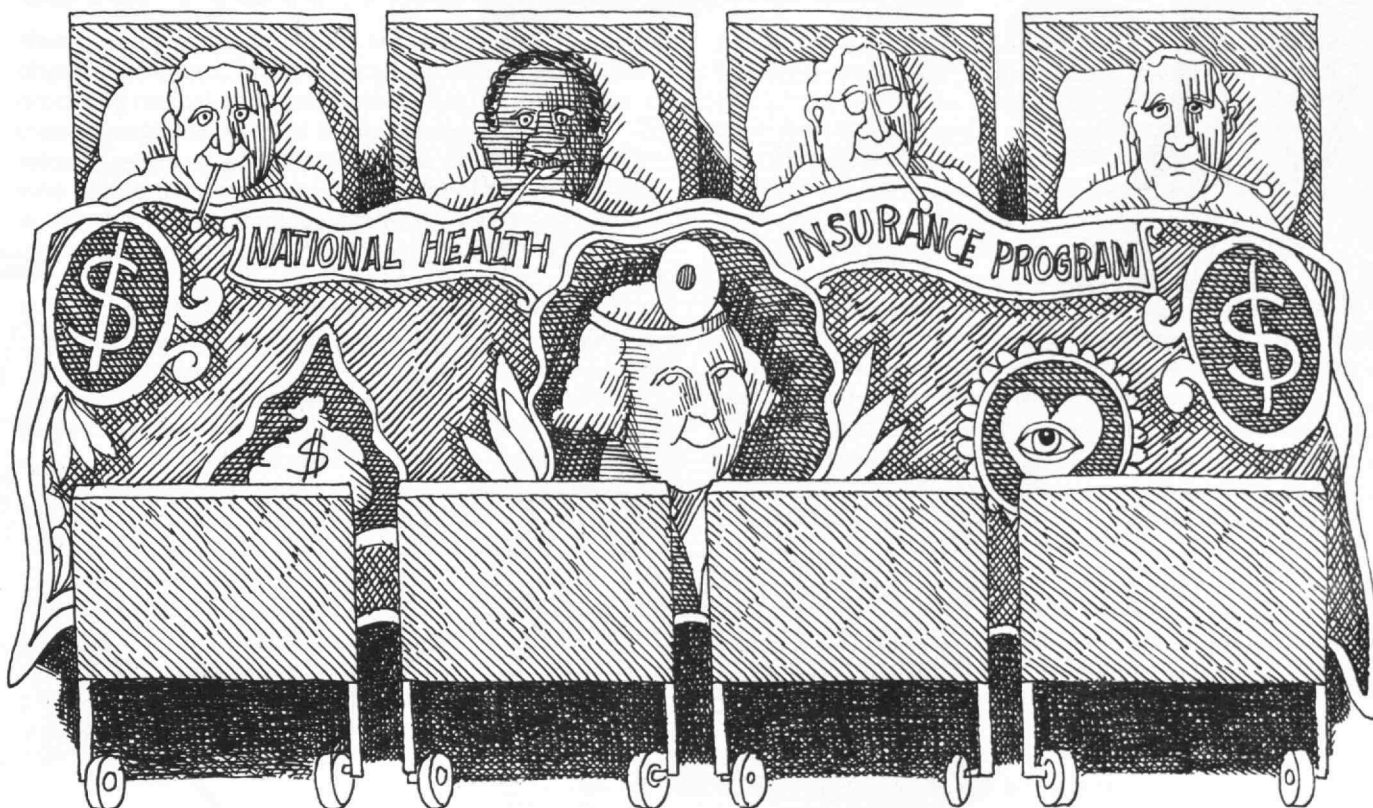
Medical care should be financed in the same way for the poor and for others, by making available to families and individuals a health insurance policy that is broad in coverage and comprehensive in scope. The costs of such a policy should be related to the income of those covered, so that the poor pay less than do those of higher income and so that those who are very poor pay nothing. The provider of services need not—and should not—know how the costs of the policy were borne, since there should be no distinguishing characteristic that relates the coverage to the individual's income.

Such a policy would allow maximum free choice, not forcing people to select between free care through some special program and costly care if they want to obtain services elsewhere. This is an important criterion. It is the way to obtain consumer input, to insure consumer choice, and to be sure of producer response.

A variety of ways can be suggested to make such policies available: they could be funded out of an increase in general revenues which are derived from a progressive tax system; they could be funded through a mechanism of tax credits with the credit inversely related to income and with those of low income receiving vouchers for the purchase of the policy (a system of tax credit without such a voucher or its equivalent in money is inadequate, for it does not provide sufficient assistance to those who owe very little or no taxes); or they could be financed out of an imaginative social security trust fund (imaginative, because one needs to obtain the possible advantages of trust fund operations and "vested rights" without disadvantages involving the potential regressive nature of the social security tax mechanism).

This is not the place to argue for a particular financing mechanism. Such an argument involves a careful assessment of political feasibility and administrative capability—and as well a rather technical discussion of alternative tax and tax credit rates and their progressivity and regressivity. There is no general answer as to which of the alternative ways of paying for a national health insurance program is most desirable. The answer depends on the specifics of the program under discussion. The important issue at this moment in time is not the particular funding mechanism for the development of a universal health insurance plan but, rather, the need for such an insurance plan.

The advantages of universal health insurance as a means of financing medical care would be many, and they would be greatest for those who are in the least secure economic position. Relying on government, but avoiding the problem of specific appropriations for poverty health care; tying the health insurance policy to a national program and thus preventing—in times of tight budgets—a situation in which the poor are isolated and the first to suffer; treating the poor as others are treated and making it impossible for the provider to ascertain the source of funding; providing a solid financial base for the operation of neighborhood health centers, group practices, or any other model delivery systems—all of these seem to me important and beneficial characteristics to be sought in the kind of financing pattern that should be available for the purchase of medical care.

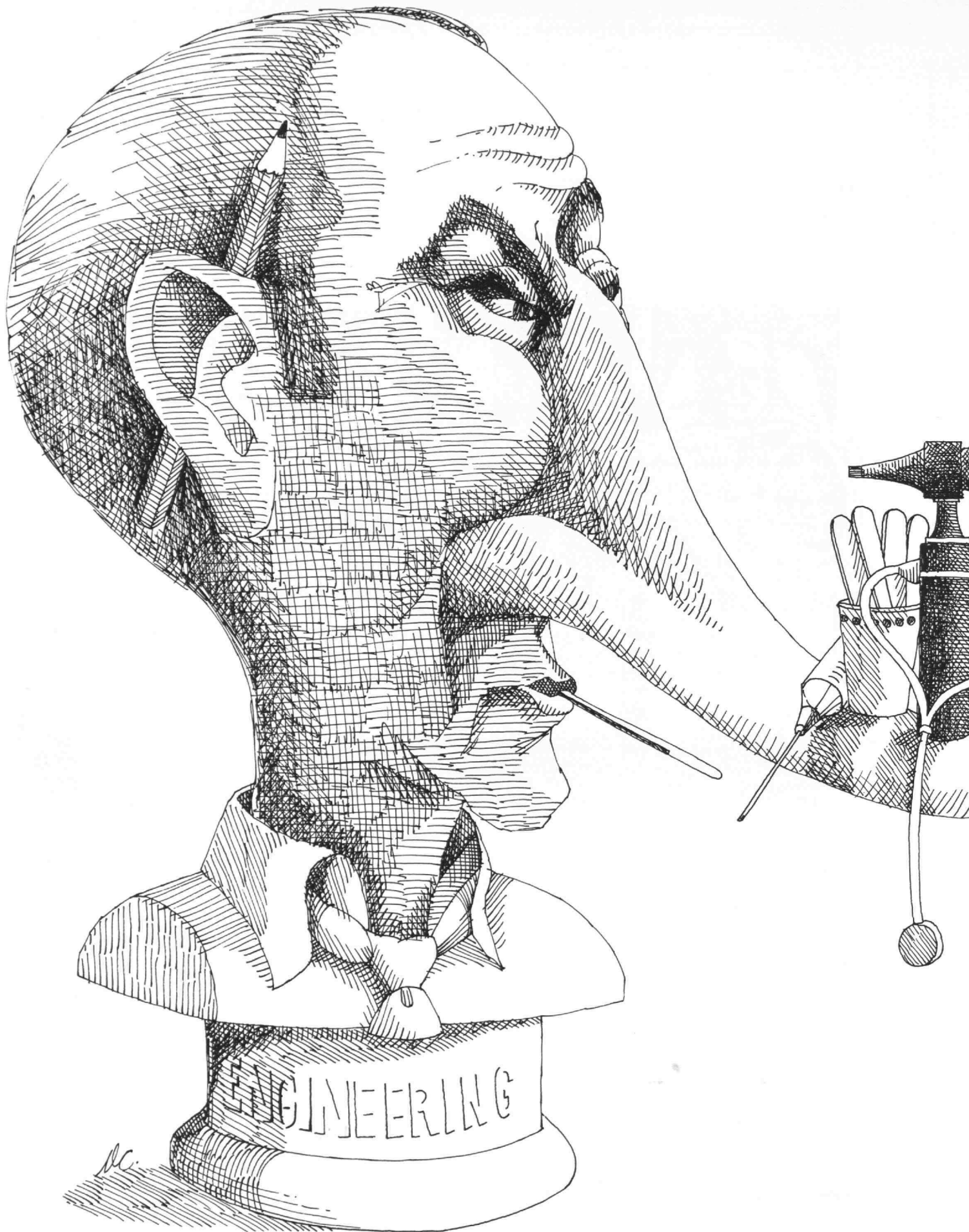


Our goal must be to achieve a situation where the amount and the quality of medical care that an individual receives is not a function of his income. This goal cannot be achieved on a national basis as long as there exist special funding mechanisms that pay for the health care of the poor. Only when there is a single system of insurance, a method of payment, not tied to income can we hope that medical care services will be delivered in ways that are themselves not highly correlated with income.

Universal health insurance does not mean that there will be sufficient doctors or that they will be in the right places or that they will serve the population as they should. It does not automatically mean that we will have a shift to ambulatory care centers, the increased development of group practice, and the greater utilization of new kinds of personnel. Nevertheless, universal health insurance provides what seems to me a sensible mechanism of financing, one that helps implement the financial side of the right to medical care. That is no

small matter. Surely not all problems are solved by national health insurance. But many are. And they are important and demand solution. It is time to address ourselves to them.

Rashi Fein, who is Professor of the Economics of Medicine at Harvard Medical School and a member of the Faculty of Public Administration at Harvard's J. F. Kennedy School of Government, spent the years 1958-68 in Washington: first as an economic statistician with the Bureau of the Census, then on the senior staff of the President's Council of Economic Advisers, and finally with the Brookings Institution's Economic Studies Division. A graduate of Johns Hopkins University, Dr. Fein has devoted much of his time to the economics and history of medicine, working at various times in the 1950's at Johns Hopkins' Institute of the History of Medicine, on the President's Commission on the Health Needs of the Nation, and on the Massachusetts Joint Commission on Mental Illness and Health.



"The medical engineer of the future will be concerned with problems characterized by a high degree of complexity and subtlety. . . . We now have the opportunity to educate a new kind of physician who might in fact revolutionize many aspects of health care"

William M. Siebert
Professor of Electrical Engineering, M.I.T.

New Technology and New Medical Education

New developments during the last few decades in the physical sciences, mathematics, and engineering have produced radical changes in the power and character of these disciplines. Many of these developments are relevant—now or potentially—to the practice of medicine and to the delivery of health care. And yet the truth is that this new technology has had, to date, very little impact on contemporary medical education.

In defense of this situation, medical school curriculum committees would no doubt argue that the physical sciences and engineering play a very limited intellectual role in current medical practice. To be sure, in addition to his drugs and his surgical instruments, the physician is now surrounded by a glittering ensemble of sophisticated gadgets that hum and blink and beep and flicker. But the fact is (and as an engineer I admit this with some professional reluctance) for the most part physicians have learned to use these devices rather effectively despite knowing almost nothing about the principles of their design and function. So, it has been argued, increased exposure to physical science and engineering is perhaps of less importance to the medical student than many other topics pressing for more time in a crowded curriculum.

The fallacy in this argument is that today's medical curriculum must be designed, not to train a student for today's professional situation, but rather to provide him with the educational foundation he will need for medical practice starting some years hence and continuing for a lifetime. The premedical student who commences his college career in the fall of 1969 will not complete his residency until well into the 1980's and will still be at the peak of his career in 2001. To estimate what the impact of physical science and engineering *should* be on current medical education we must attempt to predict the impact of these disciplines on medical practice decades hence. Obviously, given the rapidity of change, we can expect no great precision in such an extrapolation. Nevertheless, as responsible educators we must try to do the best we can—looking carefully in the present and recent past for the seeds of the future.

Physical Science and Engineering in Medicine

The contributions of physical science and engineering—past and future—to life science and medicine can be divided into two more or less distinct sorts. On the one

hand, technology produces a variety of increasingly elaborate measuring instruments, therapeutic devices, and artificial organs—gadgets, if you insist. On the other hand, the physical and engineering sciences and mathematics provide an approach, a conceptual language, and a set of analogies for describing and analyzing living systems. Consider briefly the history and present state of each of these contributions.

Medical Applications of Instruments and Devices

Most of the earlier measuring instruments of biology and medicine—microscopes, clinical thermometers, stethoscopes, sphygmomanometers (for measuring blood pressure) and the like—were developed by life scientists and physicians themselves with little help from physical scientists. The principles of these devices are so straightforward that no elaborate special knowledge or training was needed. And, of course, up to about a century ago a narrow specialization in scientific education was unnecessary. The medical curriculum was reasonably comprehensive; indeed, some of the greatest physical scientists—Copernicus and Helmholtz, for example—were formally educated as physicians.

The next round of instruments—the electron microscope, X-ray machines, ultracentrifuges, electrocardiographs, chromatographs and spectrophotometers, cathode ray oscilloscopes, radioisotope equipment, etc.—these instruments have been of fundamental importance to the remarkable achievements in medical knowledge and health care in this century. But for the most part, they have both been designed and first applied to biological problems by physical scientists rather than physicians; medical education has provided neither the background knowledge nor the training necessary to develop instruments such as these. Moreover, at least the critical applications to living systems were sufficiently straightforward that the limited biological knowledge of the physical scientist was not a serious handicap.

Some of the most recent additions to the list of measuring instruments, however, suggest that a different trend may be emerging. Ultrasonic, electromagnetic, and isotope scanning devices are being used experimentally to probe for unsuspected disease, such as tumors and arthritis, and to measure blood flow. A host of electronic devices have been proposed for processing and recording electrocardiograms, monitoring cardiac arrhythmias,

and analyzing electroencephalograms. Computers are being tried out in connection with a number of clinical data-handling problems—automated cell counters, multiphasic screening systems, automated clinical laboratories, intensive-care-unit monitors, and diagnostic aids. Clearly the trend towards technical complexity is continuing. More significantly, the clinical and physiological as well as the technological aspects of instrumentation are becoming increasingly subtle. Perhaps this is why, as Professor John Truxal of the Polytechnic Institute of Brooklyn has noted, most of these systems are still “approaching their infancy.”

Both the development and the application of these instruments require individuals who are *simultaneously* well grounded in the physical sciences and mathematics *and* knowledgeable about the real problems of biology and medicine. A team composed of complementing engineers and doctors is much less effective, and the isolated physician or engineer with conventional training is pretty much out in the cold. If this trend continues, or if to obtain more powerful and useful instruments we would *like* it to continue, then the implications for the education of both doctors and engineers are obviously serious.

A similar trend leading to similar conclusions is discernible in the development and application of therapeutic and prosthetic devices. Some of the simpler devices, such as eyeglasses or hearing aids or an artificial limb controlled by a shoulder harness, can be (and, of course, have been) effectively designed and built by an engineer or technician working to meet specifications set by a physician. More complicated devices—a heart valve or a simple pacemaker or a laser “knife,” for example—may require a team of engineers and physicians to develop. The members of one profession must be able to talk to those of the other, of course, but the knowledge that each needs of the other's field is limited. Many of the current problems of medical engineering are sufficiently simple that they can be handled by such a sharing of responsibility; the physician can readily describe to the engineer what he desires, and the engineer can explain what is feasible.

But the most exciting medical engineering problems seem to make different requirements. We can now begin to dream, for example, about artificial organs that would truly substitute in performing most of the functions of

certain natural organs—implantable artificial hearts and kidneys, pacemakers that automatically adjust rate and timing to meet the demand, a hearing aid that goes beyond simple amplification to compensate for certain forms of nerve deafness, or multiply articulated artificial limbs controlled by nerve or muscle signals. The development of such devices requires intricate compromise between the desirable and the possible. To do this effectively, genuine medical engineers, knowledgeable in both fields, are necessary.

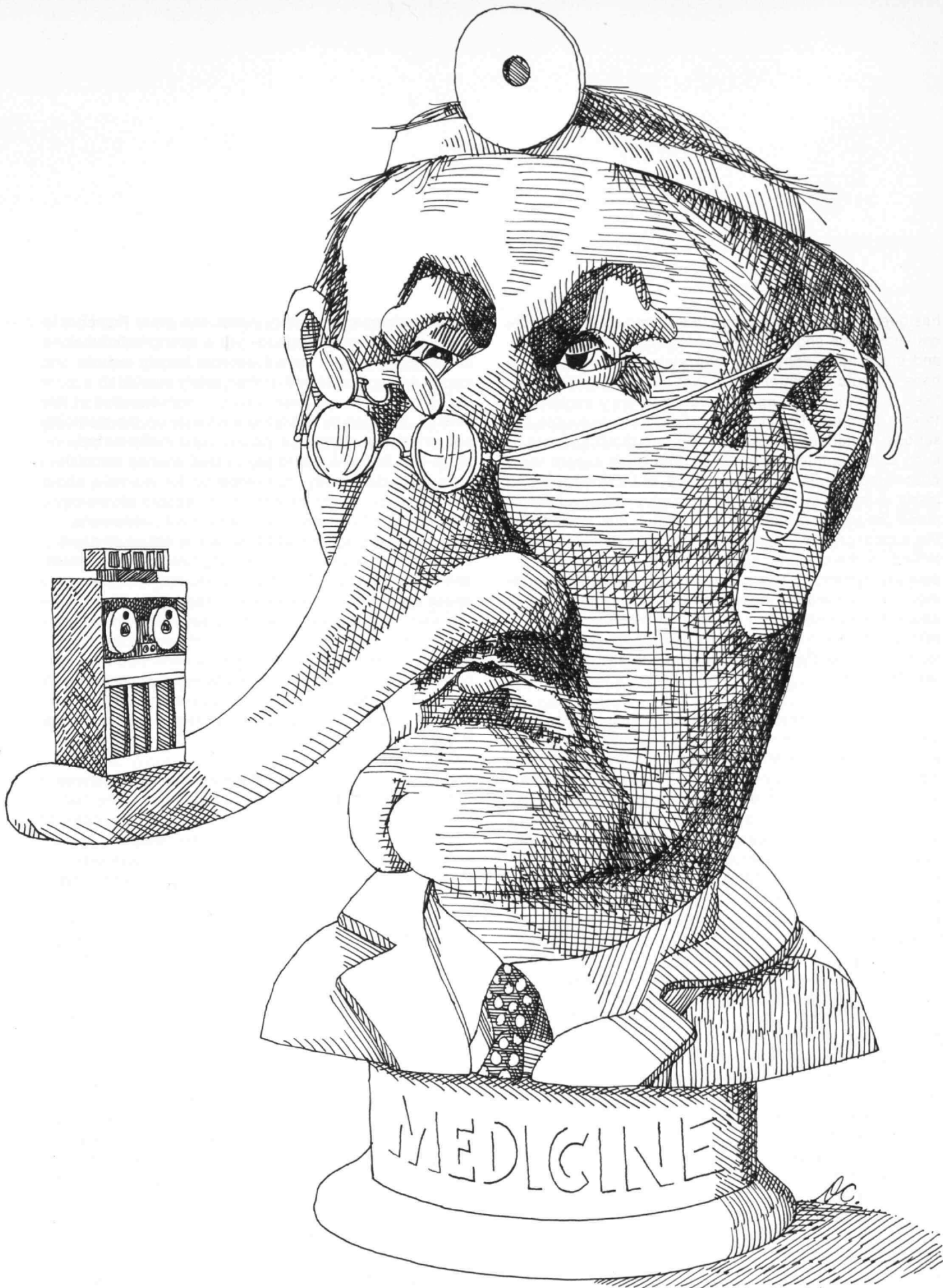
Most of the applications of computers in medicine and health care seem to require personnel with this dual kind of training, if the real potential of the machine is to be realized. Attempts to date to utilize computers in a wide variety of health problems have frequently had only limited success; effective use of these very powerful machines requires not only a comprehensive understanding of computer science but also a thorough appreciation for the details of the problem to be solved. As Norbert Wiener put it, we must not only have “know-how” but also “know-what.”

Elting Morison was worrying about the implications of deficiencies in “know-what” when he warned that “overloaded, abused, [the earlier machines developed by man] stopped work, stalled, broke down, blew up; and there was the end of it. Thus they set clear limits to men's ineptitudes. But for the computer, I believe, the limits are not so obvious. Used in ignorance or stupidity, asked a foolish question, it does not collapse; it goes on to answer a fool according to his folly. And the questioner, being a fool, will go on to act on the reply.”

It is, of course, always desirable that one know what he is doing, but the relative inflexibility of computers makes precise statements of one's objectives doubly important. And I am satisfied that the education of the new kind of technologist who knows both *what* medical questions to ask and *how* to apply technology to answer them cannot be efficiently achieved with the educational system we now have.

The Style and Language of Physical Science

Physical and engineering science also influence medicine through providing a point of view, and a rich and powerful language for talking about the function and behavior of organisms. As modern experimental, scientific medicine continues to escape its empirical past, there



has been tremendous change in the *amount* of biomedical knowledge and in its *character*—more quantitative and much more complexly interrelated—as well. Perhaps it would be better to say that the complexities have been there all along, and we are now simply beginning to sort them out. The language of ordinary discourse has serious limitations in manipulating and thinking about such complex interrelationships. English is superb for describing a pretty face or a sunset, but it is a hopelessly clumsy way to communicate what we now know about the way in which acoustic stimuli are “coded” in the auditory nerve, or the way in which a muscle is controlled, or the dynamic behavior of the heart and circulatory system. The language of mathematics is much more appropriate for these purposes, not so much because it is rigorous and numerical as because it contains a rich class of similes and metaphors (analogies) for talking about complex organizations and dynamical systems.

Calculus, simple differential equations, mechanics, and statistics have of course long been exploited in various ways to assist biologists and physicians in understanding and describing living systems. The Italian physician, Borelli, even tried to establish in the seventeenth century a school of medicine built primarily on mathematics and mechanics as the basic medical sciences. Such an extreme is clearly ridiculous. But medical education over the years has tended to go towards the opposite extreme, almost to the point of ignoring the physical and analytical sciences in favor of descriptive chemistry and biology.

The literature on medical education is full of warnings about the dangers of this practice. William Barton Rogers—the founder of M.I.T.—writing in 1841 to his brother who was teaching chemistry to medical students at the University of Pennsylvania, said, “I think no chemical course in a medical school ought to dispense with an exposition of the fundamental principles of mechanics and hydrostatics, although they are scarcely ever referred to.” Our judgment of Rogers’ wisdom is somewhat tempered by the fact that he went on to say he thought the “principles of mechanical science” were more important to the physician than such topics as electricity, thermodynamics, and “the theory of chemical forces.” This would be a dubious judgment today, but he may have been right for the period in which he was writing.

Another nineteenth century writer, the great French physiologist Claude Bernard, had a strong belief that medicine would and should become largely experimental and scientific, rather than solely empirical. He believed that medicine would, in consequence of this change, necessarily put more emphasis on the methods and principles of physical science and mathematics. Much that Bernard had to say in 1865 sounds astonishingly up-to-date today. He complains, for example, about some physical scientists who “try to absorb physiology and reduce it to simple physicochemical phenomena [offering] explanations of life which tempt us at times by their false simplicity. . . . Biology has its own problem and its definite point of view; it borrows from other sciences only their help and their methods, not their theories.” But Bernard goes on to say, “This help from other sciences is so powerful that, without it, the development of the science of vital phenomena would be impossible. . . . Knowledge of the physicochemical sciences is therefore decidedly not, as is often said, an accessory to biology but, on the contrary, is essential to it and fundamental.”

The potential usefulness of the mathematical sciences to medicine has been immensely enhanced in the last few decades by developments of system theory, control theory, communication theory, and computer science. The domain covered collectively by these disciplines is sometimes called cybernetics—a word that puts some people off because for a time the power of cybernetics was oversold. But in fact these theories do provide a means for interpreting and using collectively aspects of knowledge that in isolation have limited significance.

There have been endless studies, for example, of the anatomy and physiology of the separate parts of the circulatory system—studies of the mechanical properties of the arteries, capillaries, and veins, and of the curious nature of blood as a fluid; studies of the functioning of the valves and chambers of the heart and the muscles that operate it; studies of the transport of dissolved gasses and solids in the blood stream; and studies of the baroreceptors, chemoreceptors, and nervous structures that control and regulate the whole system.

The totality of these studies in both normal and diseased states represents a most impressive bulk of knowledge. And yet our understanding of the dynamic functioning

of the heart and circulatory system is still rather limited, because all of the pieces of the system interact with one another to produce unexpected and elaborate modes of behavior. Only through mathematical or physical models and computer simulation is it possible to begin to describe the integrated effect of these interactions as an aid to teaching and research; perhaps ultimately this procedure can become a clinical tool to predict the effect of a particular drug or surgical procedure on a particular pathological condition.

Living organisms are the most complicated systems of which we are aware; all physicians and life scientists would profit significantly from a good working knowledge of the language of mathematics, the only language suited to describing a substantial and growing segment of their field.

The Proper Goal for Medical Engineers

In summary, then, I believe that more mathematics would be a good idea for all physicians, and that at least some physicians who are also competent engineers will be needed to design and use the elaborate instrumentation and prosthetic devices that we can now conceive.

Many people, however, have worried that the cold, analytical, reductionist approach that presumably characterizes physical scientists is ill suited to the study and repair of living organisms—that simply exploring the question “how” leaves out much that is “vital,” that a physician who was at heart a physicist would be even less successful at providing the personal touch in patient care than today’s biologically oriented specialist.

Aaron Katchalsky, speaking before the third International Biophysics Congress at M.I.T. in 1969, considered part of this fear when he observed that to think of a biophysicist as a physicist working on biological problems is 30 years out of date. The modern biophysicist, he implied, is really a *life* scientist who is interested in problems for which the methods and the approach of the physicist are appropriate, and who has the skill to use these methods. Like the physicist he is interested in “how,” but as a life scientist he is also concerned with “how come” and “what for.”

Stated this way, there is little to distinguish the modern biophysicist from a properly trained physiologist or, in fact, from that substantial fraction of biomedical engi-

neers who are more interested in scientific problems than in gadgets. Indeed, in my view the only justification for the existence of such academic disciplines as biophysics and some aspects of biomedical engineering is that departments of physiology have by and large failed to reflect in their educational programs the changes in tools and attitudes that are revolutionizing their field in spite of them. As programs in physiology catch up—and I think they will—I expect some of these “interdisciplinary” disciplines to quietly fade away. This is not to say that the people involved will vanish or that their studies are inappropriate, but simply to say that in the future university they will be housed where I believe they belong—in a rejuvenated department of physiology.

The remainder of current biomedical engineering is largely concerned with gadgets or devices. Biomedical engineers, thus trained, will be needed in increasing numbers in the future, and the provision of appropriate educational systems for their training is an important problem. Many of the existing bioengineering graduate programs—such as several at M.I.T.—do a fair job; but there are two difficulties. For the most part, the life science components of such programs are inadequate in depth and coverage and ill suited in their style to engineering students. On the other hand, the engineering and physical science subjects often suffer from a disease whose consequences are observable in a large fraction of engineering graduates today. It is simply intellectually beneath these gentlemen to spend their lives designing and constructing gadgets whose principal virtue is to be pragmatically useful. The resolution of this problem—which obviously has ramifications far beyond those of immediate concern—may be just as hard as getting medical educators to appreciate mathematics.

The proper goal for the true medical engineer of the future will not be either applying engineering science to physiology or designing gadgets. His goal will be essentially identical to that of the physician: the delivery of a higher quality of health care.

For the most part, the medical engineer of the future will be concerned with health care problems characterized by a high degree of complexity and subtlety in *both* their medical and engineering aspects, such as the design and installation of artificial organs to replace or

extend the functions of living organs. Today the only way to prepare formally for this kind of responsibility is to obtain doctorates both in engineering and in medicine. This adds, of course, several years to an already overextended training period, but even so such a sequence of training is attracting an increasing number of students. Unfortunately, these combined programs are usually only partially successful, since the engineering and medical components have not been designed to interact and reinforce one another. All too often one or the other dominates, and usually it is the medical component that ends up being stronger—which says something about the relative effectiveness of medical and engineering educators.

A Possible Training Program

How, then, should the new breed of medical engineers be trained? First, all of them will need somehow to learn most of the material now taught *only* in the preclinical and (to some degree) the clinical parts of medical school programs. In addition, all will need graduate-level training in some branch of engineering, science, or mathematics. However, not all medical engineers will be directly involved with "hands on" medical care, and thus not all will need to satisfy the full set of licensing requirements.

The key words in any proposed program for these students must be *flexibility* (because the set of possible goals is highly diverse) and *experimentation* (because we obviously do not have a clear idea of how to proceed). One example of such a program may result from current explorations of M.I.T. and the Harvard Medical School; the details are still depressingly vague, but something like the following may emerge in a few years. I foresee a five- or six-year program at M.I.T., leading perhaps to a master's degree in medical science or medical engineering. Within that period, roughly 35 to 45 per cent of the students' time would be spent on basic physics, chemistry, biology, mathematics, and humanities. Of the remaining time about half would be devoted to engineering and advanced science and about half to basic medical sciences and human biology.

These latter subjects would cover essentially the material taught in the first two preclinical years of medical school. But they would be constituted rather differently; they would be designed to mesh efficiently with the type of scheduling employed for other subjects at

M.I.T., and—where appropriate—they would build on advanced science, engineering, and mathematics prerequisites and thus might achieve a level and kind of understanding not now possible. Though at first the courses in engineering and science taken by students in this program would be those that already exist, special subjects should in the end be developed with increased biomedical relevance and a greater emphasis on pragmatism than most of our current engineering offerings.

Students who complete such a six-year program would have many options, depending in part on the various elective choices they made along the way. Those who completed an adequate list of subjects in medical sciences and human biology might be accepted to the clinical years in medical school, receiving an M.D. degree in two more years. With the same or slightly different medical accomplishments and an adequate range of engineering subjects, students could be admitted to graduate engineering schools to obtain the Ph.D. degree in engineering in two or three years. Other students might seek Ph.D. degrees in physiology, biology, or other branches of science. And still others, who decided to terminate their formal education at this point, would have acquired skills that should fit them well for many tasks in the health industry.

The successful establishment of a program such as I have described cannot be accomplished by M.I.T. alone. Fortunately medical schools generally, and particularly our friends at Harvard, have begun to realize that the association of a medical school with a university is a two-way street. In return for the advantages that such a relationship brings to the medical school, the medical faculty acquires a responsibility to assist in the advanced biomedical education of a wider range of professionals than just those who plan to become physicians in the traditional sense. If medical educators shun this responsibility, biomedical engineers and scientists of a sort will be provided by other routes, but everyone will be the loser.

M.I.T. and Medical Education

Let me conclude with a minor historical footnote. It is possible that some time in the late fall of 1864, while on a trip to Europe, William Barton Rogers chanced upon an early copy of Claude Bernard's book on experimental medicine from which I quoted earlier and which bears the official publication date of 1865. In it he would have

Technology applied to health care is a different ball game, in which the pressure for development may be a principal determining factor. . . . We cannot separate these two things: head and hand."

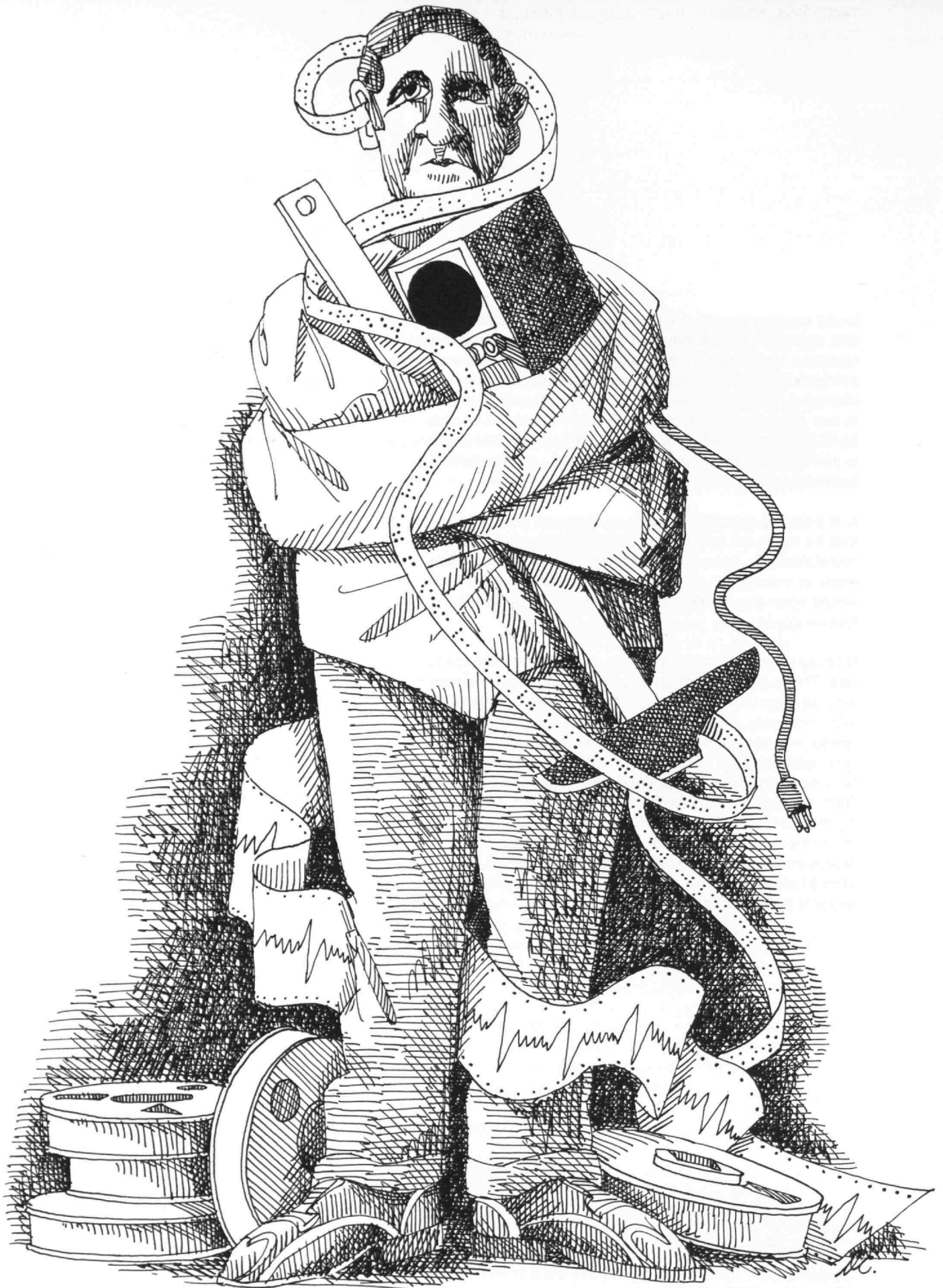
Conditions and Problems of Technological Education in Medicine

found much with which he could agree concerning general scientific philosophy, educational policies, and the relations of science to technology. Perhaps Rogers was particularly struck by a paragraph in which Bernard observes that to be effective a scientist or technologist in any field must combine theory and practice: "An able hand without a head to direct it is a blind tool; the head is powerless without its executive hand. . . . We cannot separate these two things: head and hand."

It is possible that Rogers was so intrigued by this phrase that he wrote his colleagues in Boston suggesting that, translated into the requisite Latin, it become the motto, *mens et manus*, for the new institute of technology that would open its doors to students for the first time the following year.

It could have happened this way, but we can only speculate. There is no extant letter on this topic from Rogers and no mention of Claude Bernard in any of his writings. We know only that the seal of M.I.T., including that motto, whose true origin is lost in the shadows of history, was adopted in December, 1864. But how delightfully appropriate if it happened as I described—if, right from the beginning, this institution has been influenced by revolutionary thinking on the scientific approach to medicine and medical education. For during the next few years, we have the opportunity to educate a new kind of physician who might in fact revolutionize many aspects of health care.

William M. Siebert has been active in communication sciences research in the Research Laboratory of Electronics at M.I.T. for nearly 20 years, first in fields associated with radar and signal detection and more recently in biophysics. He studied at M.I.T. for both S.B. (1946) and Sc.D. (1953) degrees in electrical engineering.



Technology applied to health care is a different ball game, in which the pressure for lower medical costs may be a principal deterrent to the effort which will make them possible

Dr. Ivan L. Bennett
Vice-President for Health Affairs and
Director of the Medical Center,
New York University

Conditions and Problems of Technological Innovation in Medicine

If one views man as a biological unit with certain physiologic, minimal requirements for calories, protein, vitamins, and trace elements, it is easy to determine the need for food: a nation with x number of physical bodies needs y amount of food. Thus the German food rationing system during World War II was based on biological principles and a centrally controlled agriculture.

However, as soon as one begins to consider a society or nation as an association of human beings with the potential quality of human dignity, a yearning for individual freedom and for the pursuit of happiness, there can be no such simple rationale as a standard food requirement. As a nation becomes affluent, food is no longer merely fuel for the biological engine or the substance that holds body and soul together; it becomes a social and cultural adornment of communication. People expect the right to exercise their preference for the type and the composition of their diets; a host of vegetarian and omnivorous alternatives suddenly open to them.

Similarly, health is a relative term. When people are so poor that their ability to provide adequate food and shelter is uncertain, health is the ability to work and health care is sought only when pain or disability preclude work. When people become more affluent, their list of desirables—or even necessities—grows. They can afford to insist on treatment for mere discomfort and on measures for assuring future health and prolongation of life. Indeed, the official World Health Organization definition of *health* is “a state of complete physical, mental, and social well-being, not merely the absence of disease or infirmity.”

Let me interrupt at this point to assure the reader that I am well aware of the fact that the subject of this article is medical technology, not medical services. But realistic consideration of technology's place in modern medicine must be based upon the totality of the health field and particularly, upon the nature and effect of recent initiatives of the U.S. government. The slowly incubating idea that health or access to health care is the right of all citizens, regardless of ability to pay, was suddenly crystallized and precipitated with the passage of Medicare—for the elderly, paid for mostly out of Social Security trust funds—and its legislative afterthought, Medicaid—for the indigent, paid for with federal and

state taxes on a formula basis. Medicare was passed largely despite rather than because of the medical profession, and, in general, it has functioned reasonably well. Medicaid, a program of the type proposed by organized medicine—if, indeed, one can use the adjective “organized” in connection with American medicine—has raised numerous difficult problems.

Both programs are political compromises, tailored to meet the most vigorous objections of the medical profession and both explicitly exclude interference with the existing system of medical care and practice. Briefly, the federal government agreed that money would be made available to purchase medical care without any direct attempt to change patterns of practice or the system for the delivery of that care; in other words, the needed services would be purchased by the patient on the open market. Thus neither the first party—patient—nor second party—doctor or hospital—pays the bill; that is reserved to a disinterested third party—government.

It has become very clear that the delivery system, as now structured, cannot meet the increased demand for care that these programs have engendered. Some refer to this situation as a “shortage,” but one may also look at it in other economic terms: when you put more money into the hands of consumers for any production-distribution system without changing the productivity of that system, you raise prices through inflation.

I wish to be very clear in stating that these two health programs have been of great benefit to many citizens. They have not, however, confronted the basic problems of health care in this country, and they will not do so as long as political emphasis is skewed so as to focus only on their successes. Medicare and Medicaid have served to expose basic defects in the existing system and to point the way towards an eventual restructuring of it so that productivity can be increased and demands can be met. But the longer the government, the medical profession, and the hospitals of this country continue to regard them much as a drunk regards a lamp post—as a means of support, rather than illumination—the more likely is the imbalance that they have helped to create and make visible to be perpetuated and, eventually, to offset their benefits.

The lessons of our experience with Medicare and Medi-

caid should make all of us realize the wisdom of Thoreau's statement in *Walden*: "Be sure that you give the poor the aid they most need . . . If you give money, spend yourself with it and . . . do not merely abandon it to them."

The annual cost of the federal government's share of Medicaid has consistently run enormously higher than estimates. Unless changes in financing are made, or benefits reduced, the program will be bankrupt by 1976. Congress has tried to reduce federal spending for Medicaid but this simply transfers the problem to the states, where resources may be even more limited.

Technology and Productivity

The history of U.S. industry and commerce shows that technological advances have generally been accompanied by increases in wages and decreases in the number of wage earners in a given industry. But not so in health care. In 1954, when hospital costs totaled \$1.5 billion, general hospitals providing acute care averaged 207 employees for every 100 patients; by 1964 costs had risen to \$6.0 billion and employees averaged 247 for every 100 patients. In one of the hospitals for which I have administrative responsibility, 67 cents out of every dollar expended goes for personnel. In another, the figure is 71 cents.

Thus the usual trend is reversed in the health field: technological advances and increases in wages have been paralleled by increases in the numbers of wage earners. The crux of the problem is whether this is an intrinsic peculiarity of hospitals or whether hospitals, unlike the U.S. economy generally, have found it unnecessary to modify procedures, change management, and reorganize to increase productivity commensurate with technological advance, improved skills and services, and higher wages. In essence, the question is whether we can invent effective substitutes for the profit motive and for realistic pricing that can be applied to the "nonprofit" sector and have their basis in the market; and whether we can, despite our policy of "third party payment" of medical costs, control that part of our increased hospital utilization which is in fact unnecessary utilization.

Until now, the medical staffs of most hospitals have paid far too little attention to eliminating unnecessary expense, leaving that task to administrators who in turn

have tended to say that they are helpless in the face of the demands of the medical staff. Responsibility, which should be shared, tends to fall between the cracks.

Increases in fees charged by physicians make a minor contribution to the inflation in health care costs. The real sources of inflation are the wages of nurses, laboratory technicians, orderlies, elevator operators, construction and maintenance workers; the costs of food and other commodities; and a whole host of other cost items that are not peculiar to the health sector. Despite the simplistic appeal of the notion that the medical profession should control all of these things, they are, in the present economic climate, uncontrollable in any sector. Their impact is greater in the health field because they are mostly related to the cost of labor, and the health field continues to be labor-intensive. There are, to be sure, faults in the medical profession as there are in other professions, but the primary difficulties that our nation faces concern the system within which the profession operates rather than the profession itself.

The rising concern over medical costs has several important results. One is that other industrial sectors who hope to find profit in the health field will discover that profit taking is no longer socially—or, in Washington, politically—acceptable. Much (though by no means all) of the difficulty recently experienced by the pharmaceutical industry has arisen from confusion between cost-reimbursement for hospital services and the pricing of an industrial product.

We are in the midst of a social revolution of rising expectations for better health care—and, I fear, on the verge of a counterrevolution of falling prospects for achieving this goal.

At the same time, there has been great concern in Washington about the "translation" of the results of biomedical research into practical applications. This leads to some other issues in the organization and setting of health care in the U.S.

The scientific revolution in medicine is barely underway. As we come to know more and more of biology, the impact of this growing knowledge upon both medical education and practice can be profound indeed. But to apply this knowledge will require technology and deliberate organization. In our market-oriented economy, we must be sure that health needs are not confused with health demands. Any program, public or private, whose object is to develop a new medical technology must eventually experience demand for development and application from the outside, and if the program's product is to be used widely this demand must consist ultimately of a market—public or private.

I do not mean to imply that the only possible incentive for development and application in the biomedical—or any other field of endeavor—is monetary profit. But we must accord this factor the importance that it deserves. It is no accident that this nation's strength in basic research flows from the universities and its strength in applied research and development from industrial laboratories.

Generally, the physical sciences have their eventual impact upon our daily lives through a manufacturing or service industry such as telecommunications or transportation. Our methods for putting to use scientific advances in the biological and medical sciences are somewhat more varied and less well structured. They are probably most efficient in the field of agriculture; with the exception of the pharmaceutical industry, they are relatively ill defined in the health field.

The Conditions for Innovation

If we identify needs in the field of health care and then compare them with the knowledge pool, we may conclude that there is considerable doubt about whether our aim, which is to fill the need, can actually be accomplished. Even if additional applied research indicates that our perceived needs are actually within the scope of technology, there remains the very knotty question of whether the end result will really be practically applied in the social and economic environment of the real world, which is sometimes a cold and inhospitable place for innovations.

There is no substitute for a thorough investigation of this situation—a market survey—before one embarks upon any substantial foray into the unknowns of a major program of development in health care. We must remember that the decision to undertake innovation and engineering development implies financial commitments of no small measure and that the expenses of development must be met whether a product, even a prototype, becomes available or not. One cannot ease into development any more than one can ease into pregnancy. There is no effective way in which a design can be tested or health care market sampled until the development process has been completed.

Another question, common to development programs in all fields but particularly crucial in health, has to do with how a proposed innovation may be compatible with customary procedures and the existing organization of the system into which the innovation will be introduced. The system of medical practice in this country is changing slowly; but it is not a system that, until now, has been distinguished by its rapid acceptance of major alteration in traditional patterns of practice.

The consumer in medicine is not, as we may think at first glance, the patient. The consumer, in the sense of the technological market, is the medical practitioner. It is the physician who decides upon the use of new products or processes or systems for health care, and his professional judgment can be interposed between the public and any innovation in the health field.

Lest this statement be interpreted as a complaint or an objection to this professional role of the physician, let me quickly add that I would not wish to see this relationship changed any more than I would wish to see each citizen become his own attorney. I mention it simply as another characteristic of our health system that must be considered carefully in planning for technological innovation.

In summary, the decision to exploit scientific advance

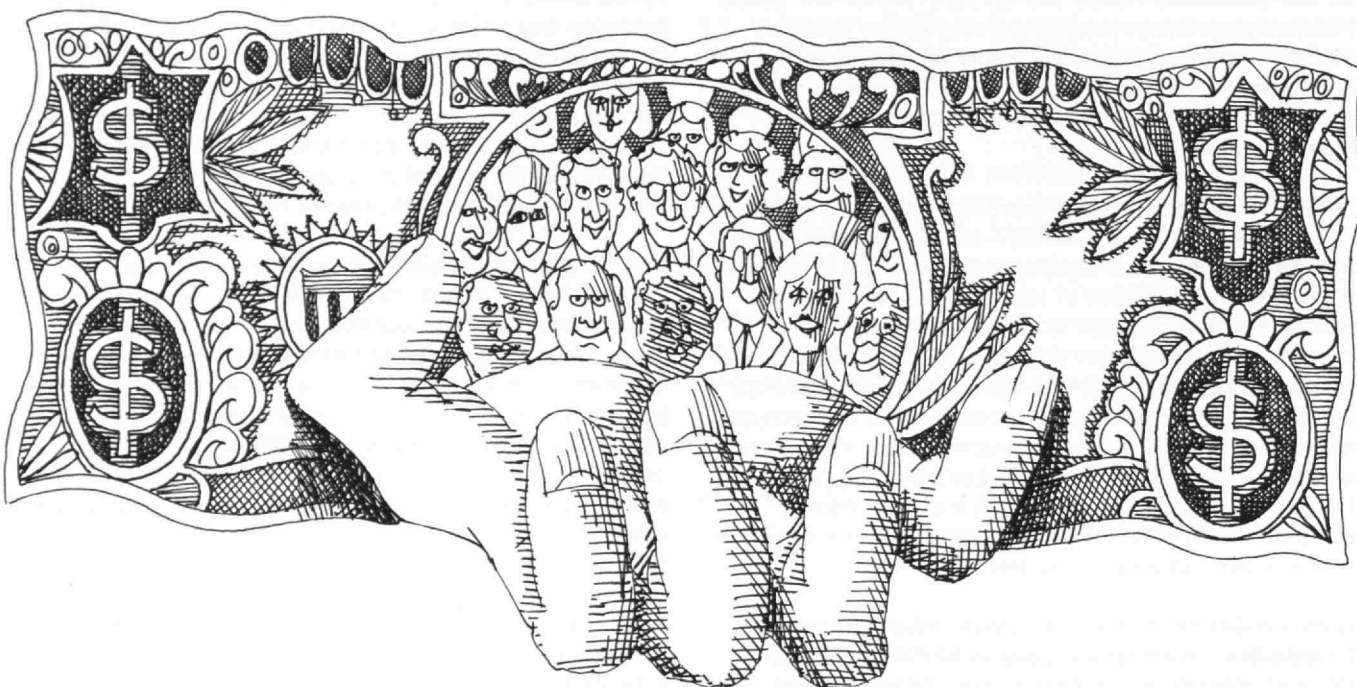
by launching into a development program in the health field—or any other field—must be reconciled with facts of life which include such scientifically “irrelevant” factors as capital obsolescence of existing equipment, the requirements and demands of labor groups, national distribution networks, compatibility with existing systems, patterns of professional activity, and even local building codes or state licensure requirements.

The smaller the impact of an innovation (such as the introduction of a new dosage form of a drug or a modification of an existing surgical instrument), the less likely that a long series of interrelated changes must be weighed in its adoption. Yet this subject is complicated by the tremendous variety of technical and economic conditions that our society presents. It deserves emphasis because those who fail to comprehend the peculiar and specific conditions for making decisions about development programs are likely to level wholly unjustified accusations of foot dragging.

Increasing experience in biomedical development is confirming what has been known for some time in other science-based enterprises—that the planning and management of programs of directed research and development are critical to success, and that directed research and development for health care is a far more difficult undertaking than the type of research to which most biomedical scientists are accustomed. The planner and the manager are likely to be involved in decisions of probable performance and judgments of reliability to be made where evidence is equivocal, experience nonexistent, and expense substantial. A mass of details involving complex economic and social matters must be harmonized with elaborate technical aspects if success is to be achieved.

The panel of the Department of Commerce's Civilian Technology Advisory Board chaired by Robert A. Charpie three years ago drew a distinction between *invention*, the conception of an idea, and *innovation*, the process by which an invention is translated into the economy. Innovation, the practical application of knowledge, is not something that just happens spontaneously; it has to be accomplished through an institution or agency. Such institutions are largely lacking in the biomedical field at present.

A technology is inert, just as is a bullet or rocket, until it



is aimed at a target and propelled toward it. I have already alluded to the difficulties of selecting good targets in the health field. Short-range targets are usually easy to find, and they usually can be hit with a shotgun-type program. Long-range targets are far more difficult and expensive to reach; it has been said that hitting such a target involves as much of a pull from the future as a push from the past. The most significant targets possess a sort of gravitational field: it is easier to go into orbit around a large target than to hit it, and many a near miss ends up circling the objective without hitting the mark.

Joining Technology and Medicine

Medical, scientific, and technological talents must be brought closely together if medical care and health are to be improved as they must be improved. But until there is some organized approach to joint endeavors on a large scale, most efforts in this area will be carried out in orbiting laboratories, and most discussions of the application of technology to medical problems will continue to resemble a dialogue in Lewis Carroll's *Alice in Wonderland*: "Cheshire-Puss," said Alice, "would you tell me please, which way I ought to go

from here?" "That depends a good deal on where you want to get to," said the cat. "I don't much care where —" said Alice. "Then it doesn't matter which way you go," said the cat. "—so long as I get somewhere," Alice added. "Oh, you're sure to do that," said the cat, "if you only go far enough."

The U.S. health care "industry" uses a diversity of specialized manpower, but its pattern is quite different from the diversity that is generally required to facilitate technological innovation. In medicine, specialization has evolved in the form of an ever-narrowing focus of responsibility and an ever-increasing depth of knowledge in one field of clinical care. The patient has been subdivided anatomically into heart, lungs, gut, brain, etc., and a specialist now takes charge of one part of what was previously the domain of a general physician or nurse. I mention this trend to specialization in medicine not to deprecate it, for I assure you that when I sustain a serious illness, I want to be cared for by the best and most skilled specialist available. However, specialization—with rare exceptions—has not been forced by or undertaken for technological innovation, and so it may tend to inhibit application of new technology.

Within the medical profession, there is a persistent perception of medical care as the domain solely of the physician. This poses great difficulties for "nonmedical" specialists who seek to work on medical problems on any large scale. It means, for example, that engineers who work with physicians on medical problems are likely to have little opportunity to participate in the selection of objectives, to formulate questions, to structure and restructure problems, and to devise alternatives for their solutions.

As anyone knows who has engaged in any large-scale, so-called interdisciplinary effort, there are intrinsic difficulties in bringing experts to work together. These problems increase with the size of the project, and they are compounded if the problem contains major social as well as technical components. The situation has rarely been better expressed than by Isaiah Berlin in *Conversations with Henry Brandon*: "As knowledge [becomes] more and more specialized, the fewer are the persons who know enough . . . about everything to be wholly in charge. . . . One of the paradoxical consequences is therefore the dependence of a large number of human beings upon a collection of ill-coordinated experts, each of whom becomes sooner or later oppressed or irritated by being unable to step out of his box and survey the relationship of his particular activity to the whole. The experts cannot know enough. The co-ordinators always did move in the dark but now are aware of it. And the more honest and intelligent ones are rightly frightened by the fact that their responsibility increases in direct ratio to their ignorance of an ever-expanding field." Simply stated, the question might be, "Who's in charge here?"

In the field of biomedical engineering, I have been told in some institutions that the success of their programs was attributable to the fact that engineers headed the effort; in other institutions I have been told with equal confidence that success had been possible only because physicians headed the program. My conclusion is not that it makes no difference who is in charge—only that it makes no difference whether he calls himself an engineer or a physician.

There are certain peculiar difficulties attendant on joint efforts in the medical field, however.

Authority in this field—both culturally and legally—resides in the physician. The physician tends to retain to himself the role of problem definer. Thus, in many instances where there has been an effort to incorporate various engineering specialties into a medical team, the physician has expected the engineers to assist him to carry out his task as he sees it—an attitude similar to that which he has always taken toward the nursing profession. There is little opportunity for shared responsibility by a truly interdisciplinary group functioning as peers.

The weight of tradition behind this attitude can change; for example, physicians and engineers in the Navy's underwater programs have a shared responsibility, work toward agreed-upon goals, and use objective measures of success and performance as criteria for

selection of alternative approaches. Here each specialist is dependent upon the other; the physician cannot ignore engineering requirements, nor can the engineer ignore the requirements secondary to human physiology.

I do not wish to overemphasize this difficulty but I feel strongly that one must not minimize it.

Organizational Patterns for Health Research

In contrast to the traditions of engineers organized for work as members of or consultants to industrial firms, as separately organized consulting groups, or corporations, the medical profession has a long history of frank antagonism to patterned organization. The health "industry" (to repeat a euphemism), being largely an extension of physicians' attitudes, reflects this antagonism in its "management" (to use another euphemism) arrangements. The dual (a better word is schizophrenic) authority—administrative and professional—that still pervades the management and organization of hospitals, for example, continues to baffle industrial management consultants; it has been rightly termed "the last refuge of the gifted amateur."

There are several aspects of this bias against organizational patterns, so traditional in medicine, that will eventually have to be dealt with if there is to be technological advance on any large scale. There are actually laws prohibiting the "corporate practice of medicine" in many states. Indeed, until only a few years ago the American Medical Association was opposed to such efforts to achieve economies of scale or better deployment of manpower within the profession as are offered by the relatively simple arrangements of group practice.

I am the last to claim that any large proportion of medical men have a real grasp of the potential contributions that technological innovation can make to the improvement of health care. But I plead for a real understanding of the nature of the problems in our health care system by technologists before it is decided that these problems can be solved by technical means alone.

In essence, I am calling for mutual understanding of and agreement upon the nature of long-range targets before we open fire on them on any large scale.

The efforts to propose that engineering skills and tech-

nologies so successful in California's aerospace industry be used to solve domestic social problems often remind me of a solution seeking a problem, and this is an example of what I deplore in the case of health care research. In other words, analysis of the problems of medical care must precede solution. We will not succeed if we merely try to adapt the problems to an existing set of methods or technologies.

Technology, Medicine, and People

Just how close is the nonmedical technical community to the real problems of medical care? As I attend conferences and hear discussions of the application of systems analysis and advanced technology to health care, I gain the impression that engineers are watching a dance through a thick pane of frosted glass. They can see the motions but they can't hear the music—and while they can record the movements with fidelity, they fail to sense the feelings, emotions, and attitudes. In short, technologists must grasp the fact that medicine is concerned with people—especially with people who are sick and who react individually, not as statistics or stochastic models, to their disease. In other words, patients are not the proper subjects for parametric gaming.

In this materialistic age even those of us in medicine often tend to become too interested in enzyme systems, in depolarization and repolarization of nerves, muscles and myocardium, and in theories of the new understandings of the miracle of the human body. We must not forget that these phenomena occur in an individual who is body, soul, and spirit. We must remember the "way of life," as Dr. Irvine Page reminds us, "that sees the material and transcendent as only two aspects of the same thing. It recognizes the results of science to their fullest but does not concurrently deny that there is something more than science. It knows that science does not know its purpose. It knows that beauty is not in the realm of science. Above all, it believes that man is not the victim of a celestial joke, but that his life has a purpose and that he is an inseparable part of whence he came and whither he goes."

Despite all that I have said about the profit motive, the economics of health care, and the prerogatives of various disciplines, all of us must bear constantly in mind the principle that was stated so well by Dr. William Middleton several years ago: "Medicine exists for the



benefit of the afflicted and not the afflicted for the benefit of medicine."

I realize that, in trying to be realistic, I have painted a rather pessimistic picture; perhaps it is too pessimistic.

Actually, I have no doubt that medicine and technology will work together productively at the difficult task of improving health and health care. I know that medicine can be better and that our ability to make it better is not limited by knowledge. As Edna St. Vincent Millay has written:

"... Upon this gifted age, in its dark hour
Rains from the sky a meteoric shower
Of facts . . . they lie unquestioned, uncombined,
Wisdom enough to leach us of our ill
Is daily spun, but there exists no loom
To weave it into fabric."

Dr. Ivan L. Bennett was Baxley Professor of Pathology at Johns Hopkins University and Pathologist-in-Chief at the Johns Hopkins Hospital when he was called in 1966 to be Deputy Director of the Office of Science and Technology in the Executive Office of the President; he has held his present positions at New York University since 1969. Dr. Bennett studied at Emory University (A.B. 1943, M.D. 1946); he has been President of the American Federation for Clinical Research (1957-58), the Southern Society for Clinical Investigation (1963-64), and the Johns Hopkins Medical Society (1963-64).

A Note on the Impact of Technology on the Practice of Medicine

Technology has already affected the *form* of medical practice, and new technology may further modify how physicians and other health professionals apply their skills.

There are two technologies which can be cited as examples, for they are universally used by the medical profession and, therefore, can be said to have affected, to a greater or lesser degree, how every physician practices. These technologies are radiology and laboratory diagnosis. Both are becoming increasingly complex and require not only expensive equipment but specialized skill in the interpretation of results. While the individual physician may use both technical modalities in his private office, the impact of these techniques has been to centralize the practice of medicine. Thus, the hospital tends to become the center of medical activity, and doctors tend to cluster around hospitals even for the care of the ambulatory patient.

This trend toward centralization of medical practice has certain advantages—particularly for the physician. He can work more efficiently if everything he needs is close at hand. Travel time is cut to a minimum, and if his office is adjacent to the hospital, he is within walking distance of his hospitalized patients. The particular technologies necessary for his practice are readily available; so are the medical specialists he can call in consultation.

The patient finds this arrangement less advantageous. He must go to a medical center rather than to a more conveniently located office or clinic; he often has to wait; and if he needs to return for various diagnostic procedures, he loses time at work. Centralization creates a very special hardship for the poor, and many disadvantaged patients fail to seek medical help because transportation is difficult, care of the family remaining at home presents problems, and the care in large medical centers often seems dehumanized—even when every effort is made to personalize medical services.

Other criticisms have been leveled at this centralization of medical care. The physician becomes more remote from the community which he serves and less responsive to its needs. The community often feels that it lacks any control over the medical care system and that it has no way of making its needs felt.

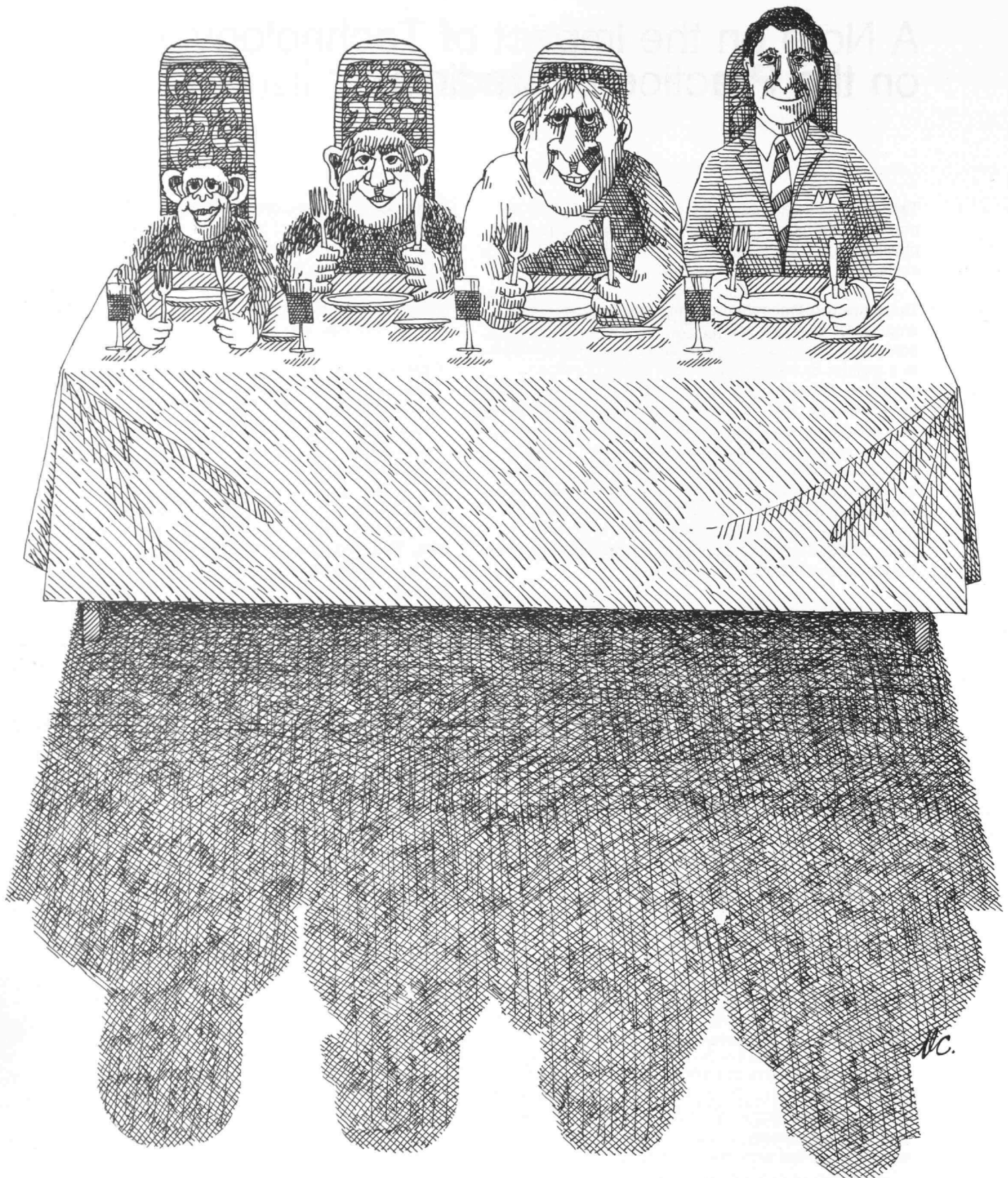
Engineering in the Broadest Sense

What is of interest is that the manner in which medicine is practiced has followed the technology rather than the other way around. Very little attention has been paid to the question, "What organization of medical services would be most convenient for the patient and the community, and how can technology solve the problem?"

If greater decentralization of medical services is desirable, there are a variety of ways in which this could be accomplished. The centralization of laboratory facilities does not mean that the patient has to go to the laboratory (only the specimen does); and the reporting of laboratory data clearly does not require proximity to the laboratory. Similarly, X-ray facilities need not be entirely centralized, and only a few very technical (and very expensive) procedures need to be done in the hospital. The reading and reporting of films does not require the radiologist to travel; the films and the information are more easily transported. In part, the specialist consultant acts as a data bank, and there are more effective ways of storing and retrieving information than through the human mind. Even examination of the patient by a consultant could be done at a distance with the help of modern technology.

Perhaps the greatest barrier to the rational decentralization of medical services is the credibility of doctors and hospitals.

The urban community, in particular, views with suspicion the efforts of health professionals to suggest experiments with new models of health care. The community feels that physicians are interested only in organizing care for their own convenience and not that of patients. The community itself is even less prepared to solve the problem. Possibly a third force is needed—engineers, in the broadest sense, who could use technology to solve the problems of medical care delivery for both the community and the medical establishment.



Man's progress is traced by his increasing effectiveness in his environment. Science, notably medical science, is at the center of this stage, and nutrition has an important supporting role

Hamish N. Munro
General Foods Professor of Physiological
Chemistry, M.I.T.

Nutrition and Human Evolution

Animals emerged as distinct forms of life probably about one billion years ago, first as single cells, then as organisms made up of groups of cells, finally developing into the many species we now know—worms, insects, fish, birds, and mammals. All types of animals from the simplest forms up to the most sophisticated so far examined show basically the same needs for dietary constituents. For example, although the proteins of their bodies contain 20 different amino acids as their structural components, all species of animals, from single-celled types up to man, can manufacture only half of these important compounds; all are dependent on the environment for the remaining eight or ten amino acids, which thus become essential dietary components. Animals cannot survive and grow if they are denied even one of these essential amino acids.

This is quite different from the situation in bacteria, plants, and molds; many bacteria and all plants are able to synthesize all the amino acids from simple precursors. It can be concluded that the branch point from which the plant and animal kingdoms evolved separately from more primitive cells was also the point at which the animal cells lost the capacity to make these eight or ten essential amino acids; part of the DNA carrying the information for making these compounds became deleted from the cell's genetic information, and all subsequent forms of animal cells perpetuated the defect. Consequently, the most characteristic feature of animals is their dependence on outside sources of carbon compounds, including the essential amino acids.

In other words, the basic feature that distinguishes animals from plants is that the animal needs to have a supply of food, and this demand has largely determined subsequent evolutionary developments in animals.

The earliest animal cells presumably survived by feeding on the dead bodies of their next door neighbors; any cell that was able to move had a considerable advantage in enlarging the area of its food supply. In this way, early animal forms that developed the contractile structures we call muscles had a tremendous advantage over their competitors and thus won in the evolutionary competition. Animals that developed the capacity to transmit messages through a primitive nervous system, to control these muscles and coordinate their action, had a further advantage. Neither muscles nor nervous systems have evolved in plants, which in general are

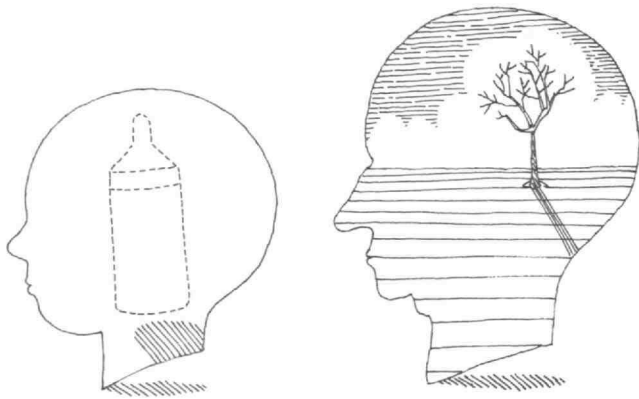
satisfied with the mineral elements they obtain from the adjacent soil.

Man has emerged as a thinking animal because he possesses a nervous system that evolved as part of his ancestor's equipment for regulating movement. Furthermore, the ideas that man conceives can only be communicated through muscular movements, originally favored because of their evolutionary advantage in the hunt for food.

The process of evolution still continues in animals; it represents the matching of the genetic endowment of the organism to its environment. In this respect, man has done well. He emerged some 2 million years ago, probably in Africa; he has spread to other areas of the globe only in quite recent times. Though the Mediterranean was probably colonized 500,000 years ago, Northern Europe received its first human visitors only a few thousand years ago and North America only 20,000 years ago. The date of human arrival in Iceland is precisely known: it is A.D. 874.

In spite of this short period of human expansion—much of it within the past 300 generations (10,000 years)—man has made many adaptations to various environments in which he lived. An example is the interesting theory conceived by W. F. Loomis to account for the emergence of the light-skinned races. He suggests that vitamin D, which is made by the sun's light falling on the skin, was not made in sufficient quantity by dark-skinned races who migrated to the less sunny northern climates. Because they made insufficient vitamin D, the dark-skinned northerners developed rickets (a softening of bone) and childbirth became impossible because of deformities of the bones of the pelvis. Only variants of primitive man with somewhat lighter skin had a chance of survival, because their lighter skins allowed enough vitamin D to be made. In this way, evolutionary pressure resulted in the emergence of the light-skinned races.

The ultimate function and justification of all science is, I believe, to promote human evolution as man adapts to his surroundings. The physical sciences, chemistry and physics, offer control of the environment, while the biological sciences not only offer potential regulation of the living things in man's surroundings, but also permit changes in the evolutionary potential of man himself. A considerable part of this intervention on behalf of man's



biological potential goes by the name of medicine. The challenge to science is thus to participate in the completion of man's adaptation to his environment, and of the environment to man. Since nutrition has been a fundamental factor in animal evolution, it must therefore continue to play a significant role in the future evolution of man.

Until recently, nutritional research has fallen far short of this demanding challenge. Consider, for example, the field of protein metabolism in which I work. No one is ignorant nowadays of the human's need for protein to supply the amino acids essential for growth and tissue maintenance, but we are still very far from agreement on how much protein is needed to fulfill these functions. The earliest estimate was made 100 years ago by Professor Lyon Playfair in the Department of Chemistry at the University of Edinburgh, who analyzed the food taken by different groups of the population and decided that two ounces of protein was the minimum compatible with survival, since this was the amount present in the subsistence diet given to patients in the University hospital. Thirty years later, a German examined the diet taken by the average working man and found that it provided four ounces of protein. Since the German of that time worked well, it was concluded that what was good for the German laborer must be good for everyone, and four ounces of protein a day became the

requirement. This comfortable doctrine did not survive for long, for an American nutritionist who suffered from rheumatism and found that his joint pains were relieved by reducing his protein intake decided to borrow a platoon of soldiers from the U.S. Army and give them a diet low in protein for many months. Not only did they survive, but it was claimed that their physical fitness surpassed that of their fellows who lived on the flesh-pots of Egypt.

Since that time, the responsibility for determining requirements of individual components of the diet such as protein has passed out of the hands of individual scientists into the anonymity of national and international committees. Even so, we still display great areas of ignorance. For example, we still do not know whether physical work imposes a need for more protein in the diet, an important question in underdeveloped countries where poor nutrition is combined with much physical labor. We similarly lack precision in understanding the body's needs for many other components of the diet.

Though this picture of nutritional research and its role in medicine is not an inspiring one, I am sure we shall do much better in the future.

Individuality and Nutritional Needs

First, I think nutritional research will in the future progress from seeking and prescribing nutrient requirements for whole populations; we will begin to recognize that individuals show genetically determined variability in their needs—that what is one man's meat is another man's poison. Let me illustrate the problem by referring once more to the question of rickets and its prevention by vitamin D. Rickets used to be a common disease in Britain; it is now uncommon because of the government policy of providing vitamin D concentrates and of fortifying the baby foods with them. However, there was a period during which some infants began to die of kidney damage which was traced to kidney calcification due to excessive intake of vitamin D; this was caused by the excessive zeal of some mothers in feeding the vitamin sources. The addition of vitamin D to infant foods was thereupon restricted, with the result that some cases of rickets began to reappear. This turns out not to be simply a question of instructing mothers so that their children receive a reasonable dosage of the vitamin; it appears that a small proportion of infants may be unusually sensitive to only *moderately* high doses of vi-

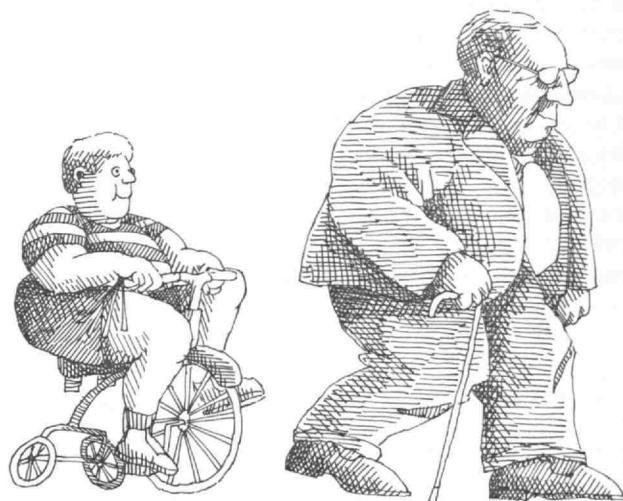
tamin D. In consequence, you have two alternatives: to make certain that no infant reaches these intakes of the vitamin, or to determine which infants in the population are liable to be sensitive and prescribe suitable doses for them.

Another example in a different age group are the variations in individuals' capacity to carry lipids, including cholesterol, in their bloodstream. As everyone knows, the frequency of degenerative disease of the arteries and of coronary heart disease has been linked through blood levels of cholesterol and other lipids to the diet—particularly to the type of fat in the diet, and perhaps also to the consumption of sugar. However, there are many different forms of abnormalities in the patterns of fatty compounds in the blood; some patients show increased blood levels of lipids when carbohydrate is taken, others respond to changes in fat intake. The important point is that you cannot legislate general recommendations for the whole population that will be beneficial to every member of it.

Nutrition and Development

The second area in which I anticipate significant results from future nutritional research is that of the early development of the animal. It is becoming increasingly evident that the environment into which an animal is born conditions its subsequent development. This has been demonstrated with rats receiving different amounts of mother's milk until weaned. If you change the sizes of litters of rats at birth so that some mothers have only two or three infant rats and others have 12 to 18 rats, you will find at the time of weaning that those animals from the large litter have not grown so well because their milk supply has been divided among a greater number of mouths. However, if the different litters of rats are now weaned onto the same stock diet, those that were in the small litters continue to grow faster than the members of the large litters. Early nutrition has thus had a permanent effect.

This general picture has recently been examined in more detail. It has been found that different organs of the body are programmed at birth to grow to different sizes and then stop; if a period of undernutrition is applied while the organ is still adding to its population of cells, the final size of the organ will be smaller than normal. If, on the other hand, the maximal size of the organ has already been achieved, a period of under-



nutrition may cause shrinkage of that organ, but it will subsequently return to its normal size when the period of underfeeding ceases. This means that, after birth, nutrition can alter the programming in the nucleus of a cell, so that its predetermined pattern of cell division and final shutoff is altered.

An important example of this principle is the growth of the brain, which attains its adult number of brain cells quite early in life—in the case of man, in about two years; in the case of the rat, after two or three weeks. Lack of sufficient milk during lactation results in a permanent restriction in the brain cell population in the rat, and there is some evidence to suggest that this can also occur in man. Restriction of food intake after weaning fails to affect brain cell population in rats, since the number of brain cells has by now become static. These changes in brain cell number have been correlated with mental behavior.

Evidence of mental retardation has been demonstrated in the case of animals; but in the case of children it is much more difficult to separate the effects of malnutrition on subsequent intelligence from the effects of social environment, which is usually bad where malnutrition is present. The suspicion nevertheless remains that malnutrition at an early stage of life has a permanent stunting effect on the mental development of man.

Although the emphasis in such studies is usually on undernutrition, the development of the body can also be conditioned by early *overnutrition*. Just as the undernourished animal remains permanently stunted, so the animal overnourished during early development tends to put on excess fat, due to the appearance at an early age of an excessive number of fat cells in its adipose tissue. The same is true of human subjects. People who first become obese in childhood develop additional fat cells which remain with them throughout life, even if food restriction is practiced. In that case the extra fat cells lose some of their load of fat; but they continue to signal for extra food, and the victim has a persistent desire to eat.

Obviously, we must pay much more attention to patterns laid down in early childhood. We must find ways of assessing *the individual* as a metabolic machine and then prescribing a *personalized* program for the optimum conditions of development for that individual. To do this we will need much more refinement in our measurements than we presently have. We shall have to measure with the aid of computers the detailed pathways through which foods are utilized within the body, so that variations in the proportions going by one pathway or by another in different individuals can be detected. On the basis of such information, we will be able to define the biological characteristics of each individual.

A few years ago, I participated in a conference on the life-support systems needed for astronauts during the six- or eight-month flight to Mars. This really tests the solidity of nutritional knowledge. Every source of extra weight has to be eliminated in order to keep down the payload; on the other hand, one must keep the astronauts healthy, since space funerals in the absence of gravity present special problems. We struck our first problem as soon as we tried to calculate how many calories of energy each astronaut should consume during the six-month period in order to maintain his weight. We could not make even this elementary prediction without an intolerably large margin of error.

This type of question cannot be answered without much more detailed quantitative knowledge of how the body regulates its energy output and utilization. For example, one school of thought holds that people grow fat not because they eat more than the average member of the

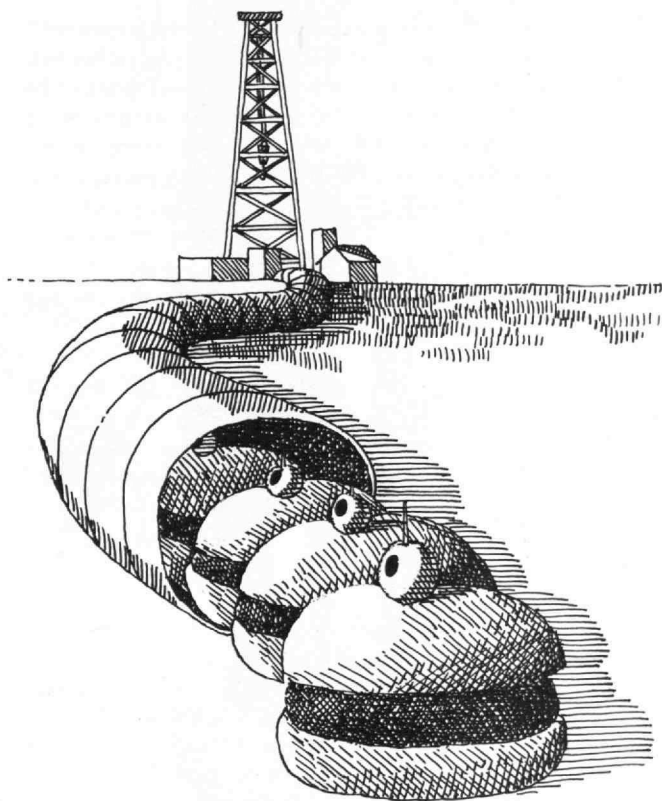
population, but because their bodies do not cause the normal partial wastage of energy that is an accompaniment of each meal. If the theory is true, it adds one more example of individuality in food needs. One might assume that a problem such as this would be easily resolved by a vigorous program of appropriate experiments. This has not come about for two reasons: too few people work in this field, and the field has such a low priority among the excitements of biological science that those with the necessary sophisticated experience have not cared to interest themselves in this question.

The significant nutritional research of the future must engage itself more and more with studies performed at the level of the cell. Until recently, nutritional research has fallen far short of this demanding challenge. Only in this way will the recent advances in basic biological science make an impact on the future development of nutritional research, giving it depth and eventually precision.

Food Supplies of the Future

Finally, I come to the question of whether nutritionists can play any effective part in alleviating the present problem of undernutrition in various emerging nations of the world, and also among the poor of the United States. You may think that I should have given this first priority, as being the principal means by which nutritional knowledge relates to medical practice. I do not agree. To begin with, there is evidence that agricultural productivity is now increasing a little faster than population. This occurs not only because of steady improvement in agricultural methods but also because of dramatic improvements through plant breeding. But the situation in industrialized communities is less certain; the farmer is a disappearing breed, like the horse, and in the long run we must look to unusual and novel sources for rapidly increasing food supplies, thereby liberating man from one major environmental hazard. Herein lies a real challenge to the skills and experience of scientists studying nutrition and food science. They must use ingenuity in looking for likely new materials to act as sources of foodstuffs, and they must use sophisticated methods of testing the products for usefulness and for potential dangers.

This area of new research has received considerable stimulus from the space program. It will not be possible on long space missions to transport enough food for the



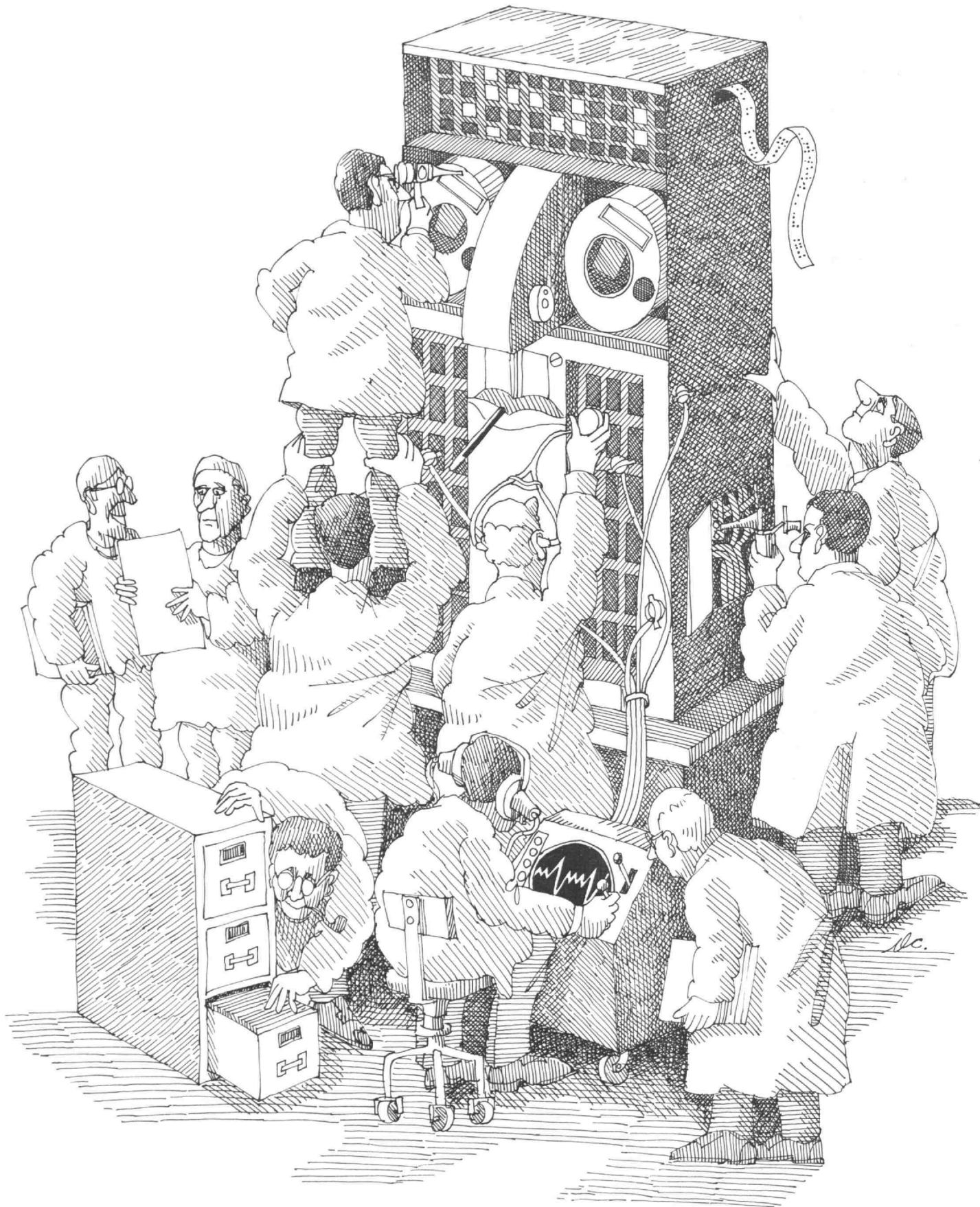
journey, and the ingenuity of scientists from various areas of biology has been devoted to the question of utilizing the waste products of the astronauts in order to synthesize edible products. Suggestions include the chemical synthesis of carbohydrates from carbon dioxide and water and the growth of various types of bacteria, yeasts, molds, and primitive plants on excretory products. This work has provided a considerable incentive to more general research on these unusual food sources. For example, photosynthetic algae use sunlight much more efficiently than higher plants and can be maintained under conditions where crops are produced continuously, not seasonally. These algae synthesize protein and vitamins as well as providing carbohydrates, and it has been computed that one square meter of algal crop could renew itself fast enough to maintain one man. At M.I.T., scientists are also looking into other sources of protein for man, particularly yeasts and bacteria. This work demands many research resources, including pilot-plant methods for growing and processing the organism, careful laboratory work to examine the

product for hazardous components, and facilities for testing on human subjects. Another group has been working on new compounds that can be used as sources of energy for the body.

The eventual success of such programs will depend on the harnessing of these processes of artificial food production to industrial resources. For a number of years, oil companies have been interested in the possibility of using petroleum by-products, such as gas-oil and paraffins, on which to grow yeasts and bacteria. After only about ten years of research, there is evidence that a safe and useful protein ingredient of animal feeding stuffs will be achieved in the near future. There is no reason to believe that a product suitable and acceptable for human consumption will not soon follow. The important point to recognize is that, through its use of oil wastes, the product shows prospects of becoming economically desirable. If this can be achieved in other areas of industry, then the incentive for producing new and novel sources of food will quicken. Once more, the environment in which man is evolving is being subject to control.

The scientist is nowadays a respected, if sometimes feared, member of the community. The public knows that much can be expected of him. I have tried to show that science is a form of organized evolution directed towards the perfection of *physical* man in his environment. Within this proud objective, nutritional control of man and his environment at all stages of his development plays an important part.

Hamish N. Munro came to his present post at M.I.T. from the University of Glasgow in 1966; but he was then no stranger to the U.S., having participated frequently in scientific meetings and conferences, including the Gordon Nutrition Conferences, and as a member of committees of the Food and Nutrition Board of the National Research Council. He is widely known for research and writings on mammalian protein metabolism.



... Our highest priorities are not for another model of the theoretical application of queuing theory ... What we need now is extensive experimentation ...

Dr. G. Octo Barnett
Dr. Jerome H. Grossman, and
Dr. Robert A. Greenes
Department of Medicine, Harvard Medical School;
Laboratory of Computer Science,
Massachusetts General Hospital

The Computer's Role in Health-Service Research

The application of computers in the space-age race for the moon and the application of computers to the care of patients began at about the same time. The former has been spectacularly successful, the latter a stumbling effort still in its primitive stages. The difference is obviously related in part to the quite different nature of the objectives and support available. But there are other reasons. This paper will describe in part the current state of the art of applying computer technology to patient care and discuss some of the ways in which this field is unique.

Such a discussion is always a dangerous venture, for in medical computing the difference between realistic possibility and hopeful fantasy can be quite subtle. Computer-assisted patient care is a particularly hazardous subject because the potential for change seems truly global.

The delivery of health care is essentially a problem-solving activity, depending heavily on the processing of information. A physician's work entails collecting accurate information, precisely formulating hypotheses and testing them, and efficiently managing many individuals and large amounts of data. As medical care comes to depend less on the individual physician and more on the coordinated activity of several professional and auxiliary personnel, timely and productive communication becomes increasingly important. The geographic mobility of people in general—among them, our patients—and a growing concern with the prevention of illness and the management of chronic disease make the long-term storage and ready availability of data essential.

There have been a number of productive applications of computers in patient care, which have begun to reveal the importance of the new technology and to shed light on the processes whereby it is assimilated into the health-care world.

However, the casual reader should not be deluded by the flamboyant claims of the enthusiasts. Experts in this field are renowned for their failure to anticipate the implications of their innovations for patient care, administration, and labor.

There are several fundamental issues which need emphasis, as they are frequently misunderstood or ignored

by engineering consultants, by the computer industry, and by hospital administrators.

(1) Most important, computer technology cannot be viewed as an isolated entity, important in its own right. Highly sophisticated instruments—for example, new and more elaborate pressure transducers, or special-purpose computers for detecting cardiac rhythm abnormalities—have played an important role in advancing medical knowledge and have resulted in better care for a limited number of patients. However, they have had no great impact on the day-to-day problems of patient care.

Medical care is a series of intense interpersonal experiences, which can be fully understood only when viewed within a complex social-political-economic context. Technological issues must be considered in terms of the total problem: it is foolish to design a technological solution in the abstract or for an irrelevant "problem."

(2) The extent to which computers can be applied to patient care is limited only in part by the cost and power of available computer systems. Equal or greater limitations are: our inability to state explicitly our problems and objectives; the lack of an easy medium of communication between people who are not computer-trained and the computer; the fact that medical practitioners are unsophisticated about computer usage; and the inadequacy of the manpower available for computer development.

(3) The application of computers is a development problem. Even though we may be sure that a job can be done, if it has in fact never been done before all kinds of unknown difficulties are sure to emerge. Development is expensive and always seems to take twice as long as it should.

(4) The belief that computer techniques can be easily transferred from one field to another must be abandoned. One of the most damning fabrications perpetrated by the computer industry is that application systems can be independently developed for a new kind of user as a marketing service.

Fundamentally, the use of the computer in medicine can be widespread and successful only to the extent that the medical care experts themselves come to un-

derstand the machine and find out how to apply it to their needs. Patient care has its own kinds of information-processing tasks, which are unique, no matter how similar they seem to those of other fields on the surface. To be successful, the computer must function as part of the everyday operation of a hospital. Until that happens, applications remain isolated and peripheral, and have little impact.

(5) The approach that begins with a total systems analysis must be reevaluated. Only through considerable experimental effort—developing and evaluating a number of alternatives—is it possible to arrive at realistic specifications for a computer system and requirements for information-handling procedures. We do not accept the assumption that we require a system for fulfilling our needs as we presently define them.

As Galbraith has pointed out, the successful application of technology requires the division and subdivision of the overall task into component parts, to the point where each subdivision matches up with some established area of scientific or engineering knowledge. The implication for medical care is that we must decide upon specific objectives, and then divide the tasks into component parts with explicit definitions. The most appropriate approach would therefore be to concentrate attention on such partial computer-system modules as can be made operational now—not on total systems that may exist sometime in the future.

The Score So Far

Computer technology has already had an impact on the medical system in several areas. The four most widespread applications have been in accounting, scheduling, patient monitoring, and automated laboratories.

The business functions of the hospital were the first to be automated, and almost any hospital of any size has some type of computer-based billing, mostly employing simple modifications of approaches and equipment used in industrial settings. There has not been much of the sort of innovation that would help to reveal (for example) the true cost of specific hospital services; there has been virtually no effort to measure the costs of alternative ways of organizing treatment.

This kind of information is desperately needed: any significant cost/benefit analysis of medical care is *still* impossible, not just for lack of tools to measure benefits, but also because we have little documentation of costs. (It is often suggested that computer-based information systems may help to moderate the spiraling costs of medical care, but this has been almost impossible to demonstrate because of the paucity of information on the costs of the present manual methods.)

Scheduling in most large hospitals is, to paraphrase Churchill, anarchy surrounded by confusion and wrapped in chaos. Lack of coordination in the scheduling of admissions, operating rooms, X-rays, discharges, and ambulatory visits is undoubtedly one of the most wasteful aspects of hospital operations. Certainly it is a prime source of irritation and frustration to both physicians and patients.

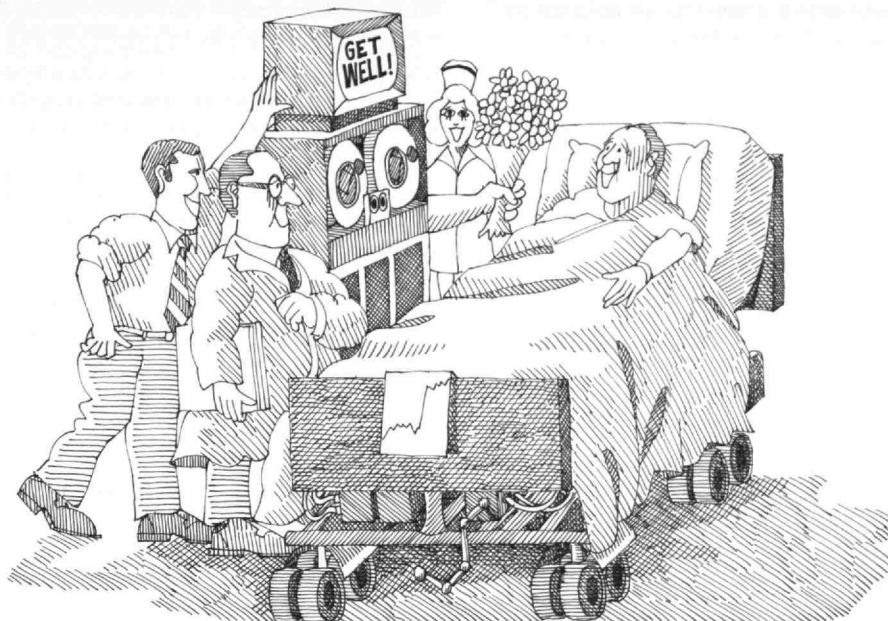
But it is no use applying the computer for scheduling before the conflicting interests of the various hospital power groups are reconciled and ground-rules for the allocation of resources are defined. Thus far, experiments in computer-assisted scheduling have amounted to little more than the mechanization of bookkeeping. They have not involved any significant reexamination of how the scheduling of a particular function interacts with the rest of the medical care system.

Consider for example the automation of the instruments and procedures of clinical laboratories. Largely as a result of today's automated laboratory systems, medical care is becoming increasingly based on chemical or physical analysis of body components and characteristics of body function. Computers are being used on an expanding scale, both in private hospitals and commercial laboratories, and soon every clinical laboratory of any size will have access to some sort of computer system. The relative success of this particular application was aided by several circumstances. The laboratories' objectives are relatively simple. The data are numerical. And laboratory staff are technical to begin with. However, it also helped that the clinical laboratory in most hospitals is an income-producing activity, and its director is thus in a position to command funds for the latest and most sophisticated equipment. If any of the work of the nursing staff were an equally obvious income-producer, the automation of medication would be much more advanced than it is at present.

Patient monitoring attracted the interest of computer-oriented engineers early in the game, probably because the signals are easy to measure and the analysis techniques superficially simple. However, development actually went very slowly for the first decade, and only recently has there been any evidence of improved patient care. This delay was due in part to physicians' and engineers' failure to understand the need for close and continuing collaboration. The most spectacular failures occurred when an engineering group developed a system independent of a critical and continuing medical contribution. Some of those early commercial ventures made the Edsel seem a rousing success.

The recently successful patient monitoring developments have one interesting characteristic: they are among the few applications with any significant transferability from one hospital to another. Monitoring deals with patients, and patients at different hospitals are much the same; whereas in administration, a particular unit of a specific hospital will have its own peculiarities. The computer can undoubtedly improve the functioning of a unit or service in a given hospital, but it is unlikely that other hospitals will be able to take over such a development directly.

In summary, innovations that use computer technology are most successful and best accepted where there is cooperation between computerniks and health care experts, with clearly identified needs and well-defined objectives. Such criteria are not often satisfied in health care research; indeed, projects in this area can almost uniformly be characterized by poor communication, diffuse purposes, and grandiose objectives.



The Stress of Technology

Our most productive approach will be to design modular systems for present needs within a structure that can be gracefully expanded. Two agencies have the power to bring significant change to the health care delivery system. One of these is government, through regulation of licensing practices and payment for services. The other is technology.

It has been repeatedly demonstrated that technical innovation of a widespread or radical nature inevitably leads to organization change. As Victor Fuchs has stated:

"The medical profession, or at least a significant portion of it, seems to believe that there can be rapid and far-reaching technical change without disturbing the traditional organization of medical practice. This belief is irrational." It may well be that the resistance to change which permeates so much of the power structure of the American medical scene will be broken not by governmental action or by guidance from professional societies, but by the internal contradictions and resulting stresses caused by technological innovation.

Health system research currently places great importance on planning and on evaluating theoretical models, but little on experimentation with operational systems. There is obviously a need for planning to identify specific objectives; it would be foolish to develop technological innovations without a clear understanding of the process of delivering health care.

However, most of the problems are already known, and our highest priorities are not for another model of the theoretical application of queuing theory, or for a new master plan for a health care delivery system in some urban or rural area. What we need now is extensive experimentation on many levels.

Pure ivory-tower research has its place, but so does experimental research. We talk and write exhaustively about the use of auxiliary medical personnel, about how to organize physicians to optimize the use of professional time, about how to motivate hospitals to provide

more efficient services, about how technology can make the care of patients more effective. The ratio of theory to experimentation seems disproportionately high. Fundamentally, the provision of health care is not a problem that will be solved by graduate student theses in industrial management, or by changing linear functions to quadratic functions.

The action is not in theoretical research. It is in the delivery of health services in urban hospitals, the provision of services to neighborhoods without physicians, and the increasingly effective utilization of physicians and auxiliary medical personnel. The problems are in the medical care establishment of today, and it is here that the problems must be confronted and solved.

We will never be able to modify the attitudes or change the behavior of physicians, hospitals, patients, and probably not even of politicians, by learned papers or impassioned polemics. Bringing computers to the health services is not an end unto itself; its purpose is to provide an approach and a tool to assist in the experimentation that is so badly needed.

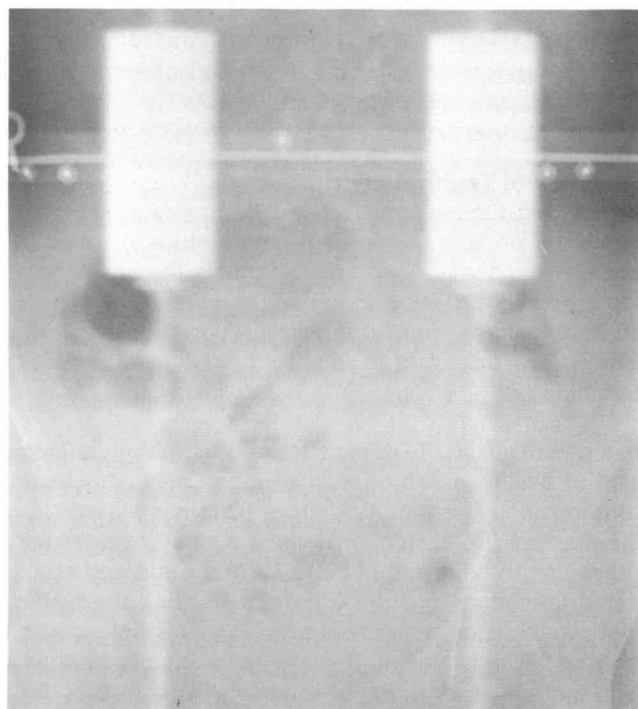
Computer technology alone is a distracting and expensive toy. Computer technology when used by a sophisticated group working on a realistic need with well-defined objectives, in an appropriate medical care delivery environment, has almost unlimited potential.

Guy Octo Barnett is an Assistant Professor of Medicine at Harvard Medical School (where he obtained his M.D.), an Assistant Physician at Massachusetts General Hospital, and a Research Associate in M.I.T.'s Department of Electrical Engineering. In the Society for Advanced Medical Systems he is Vice-President for Computer Technology. Jerome Harvey Grossman—a graduate of M.I.T. and member of M.I.T.'s Alumni Advisory Council—is Assistant Director of Massachusetts General Hospital's Laboratory of Computer Science, and an instructor in medicine at the Harvard Medical School. He is also a Director of another "M.I.T."—Medical Information Technology, Inc. Robert Arthur Greenes holds a doctorate in Computer Science from Harvard. He too is an Assistant Director of Massachusetts General Hospital's Laboratory of Computer Science, and a Harvard Medical School instructor in medicine.

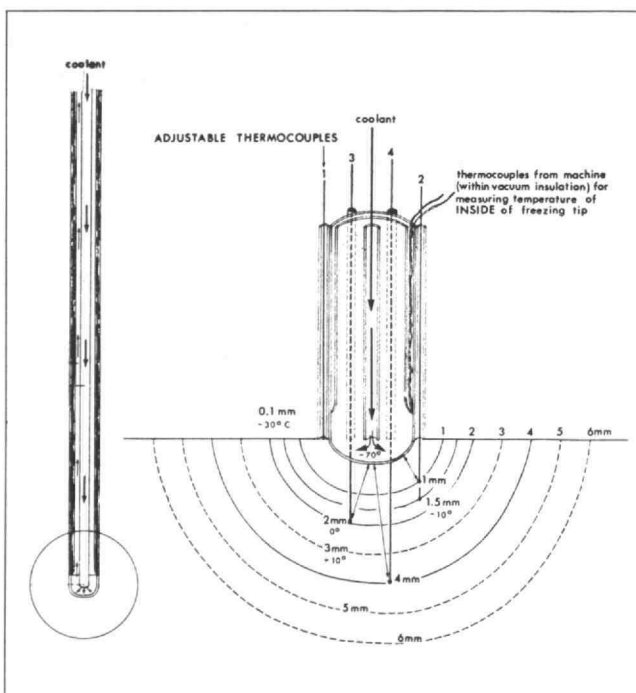
Among the advanced technologies which may or may not be worth applying in medicine is the processing of images by computer. Below is an X-ray of a human wrist, scanned for digital processing but otherwise unaltered. The version beneath it is the result of a program which slightly diminishes the contrast of large features while greatly increasing the contrast of small details. (Supplied by Professor W. F. Schreiber of M.I.T.'s Electrical Engineering Department)



M.I.T. continues—with increasing sophistication—one of the pioneering applications of high technology to clinical medicine: megavolt X-ray therapy for the treatment of malignancies. Here is an example of a recent development in the High Voltage Research Laboratory for treatment of abdominal malignancies. Because the radiation tolerance of the kidneys is lower than the dose required for the tumor, which may be disseminated throughout the entire abdomen, a technique, of synchronous rotation with rotating "kidney protectors," has been developed. The radiograph below shows the treatment field and the shadows of the "kidney protectors."



Less sophisticated technologies—but no less difficult mechanics—are involved in such surgical instruments as the cryosurgical cannula (bottom), used to remove heat at a rapid rate from a small area of the brain. Thermocouples permit monitoring of temperature gradients. (Drawing: Cryogenic Surgery, Dr. Irving S. Cooper, from *Engineering in the Practice of Medicine*)



Technology and medicine should be happily married by now—but they are still only conducting a shaky courtship. Here is a summary of the potential and some suggestions about why it has not been consummated

Samuel Moffat

Promises, Promises— But Few Wedding Bells

The January issue of *Fortune* magazine described Mt. Sinai Hospital in New York City as “one of the most extensively automated big hospitals in the nation.” It is a university-oriented teaching hospital equipped to provide patients the very latest and best in medical care.

And yet during the 24 hours of January 15, 1970, the latest in electronic equipment was used in the care of only about 2 per cent of the patients at Mt. Sinai. This figure does not include electrocardiographs, electroencephalographs, or X-ray machines—devices that have been used for so long they can hardly be considered new innovations. Nor does it include procedures carried out in the clinical laboratories or operating rooms. But the total is remarkably low.

Even when the records of the patients hospitalized on January 15 were reviewed for care received since they had been admitted, only 6 per cent had benefited from electronic gear.

Dr. Irving J. Selikoff of Mt. Sinai School of Medicine cited these figures in San Francisco recently during a conference on electronics in medicine, sponsored by Electronics/Management Center and four McGraw-Hill, Inc., publications, in an attempt to assess the impact of new technology on medical practice. For, as he pointed out, “I live in the real world of coronaries, pneumonia, strokes, and cancer.”

But perhaps the record was better outside the hospital, where 90 per cent of the patients are treated. Not so, Dr. Selikoff reported: “It’s a wasteland.” During the 128,000 visits to the East Harlem Health Center clinics in 1968, about 100 audiograms were obtained. Outside of ECG’s and X-rays, that was it.

Dr. Selikoff’s conclusion, presented to the more than 400 assembled experts in medical electronics: “Your recent contributions have been largely irrelevant to patient care.”

Strong as it was, this statement is borne out almost at every turn. In professional articles, public pronouncements, and private conversations, the doctors lament it and the engineers and physical scientists admit it: There have been a few dramatic, highly publicized and sometimes enormously expensive advances, principally available in the large medical centers. But by and large

the care most of us receive is virtually unchanged by technological progress.

One might think that after all these years, technology and medicine would be happily married. They continue courting, of course, because they are attracted to each other. But medicine has been a reluctant partner so far. Technology has promised a great deal but has not delivered enough to make medicine want to give up its old way of life.

Even the most pessimistic observers, however, are confident that technology’s promises will be fulfilled increasingly as years pass. Public pressures seem as likely to induce changes as any industrial intent. The accelerating demands for health services and the serious shortages of health personnel will make greater dependence upon technology mandatory. These factors are involved in industry’s continued confidence that the health field will be more profitable in the coming years. A marketing report issued this February by DMS Inc. of Greenwich, Conn., predicted that the medical electronics market alone will multiply 2½ times in the next half decade, and will be approaching \$2 billion by 1975.

The problems that have limited the technological impact on medicine are explained partly by the difficulties of working at the knowledge frontier and partly by the characteristics of American medical practice. They are documented over and over again during conversations you are likely to have at a biomedical engineering meeting, such as the 1969 M.I.T. Alumni Seminar on “Technology and Medicine” or the more recent San Francisco session. The practicing physicians (not the researchers) attending such a meeting will tell you that they are still waiting, after all these years, for some really useful clinical equipment. They may want something as simple as an improved tongue depressor or something more complex—an electronic stethoscope, for example. But the engineers attending will tell you that most of the devices the doctors want have already been invented, sometimes 10 or 20 years ago. The trouble was that the doctors would not buy them. “A lot of people have lost their shirts building electronic stethoscopes,” is a typical comment.

In between these two polarized groups are a few biologists (including physicians) and the physical scientists or engineers who have broken down the bar-

rier between their disciplines. (For simplicity, I will group physical scientists and engineers together for the rest of the article under the term *engineers*.)

Elsewhere in this issue, Dr. Ivan L. Bennett, Jr., touches upon some of these problems in general terms. I would like to be a little more specific because the doctor barrier can effectively prohibit the development and, equally important, the acceptance of useful medical devices.

The Communications Breakdown

The most difficult and most frequently occurring problem can best be described as the communications breakdown. It may occur at almost any time—during planning of research, at any stage when it is being carried out, and even as late as the marketing period.

Suppose a physician believes he could use a device to detect the pulse in one of the arteries in the leg. But perhaps this is not the only or the best parameter to measure. What he is really after is information about the circulation in the lower extremities. An engineer might ask whether this information could be obtained from the temperature or skin color as well as a pulse. The first problem, then is to get the problem stated in its real terms. For centuries, doctors have had to rely on certain indirect evidence in clinical practice. Technology may make other evidence more useful.

Later on in research the physical scientist or engineer may find himself in trouble because he has been too successful. This has proven an obstacle in the development of electronic stethoscopes. Some of these devices reproduce more sounds than physicians are accustomed to hearing through their traditional rubber-tube instruments. The electronic system gives doctors more information than they are prepared to handle, and they will not change their ways.

In some cases, this is just the difference between old and new technology. At other times this sort of difficulty can be related to what Professor George N. Webb of Johns Hopkins University calls "engineering overkill": too many knobs and too much engineering detail for physicians or their delegated aides—nurses, technicians, and so on.

Engineers must constantly remember that their training and even basic habits of mind are very different from those of physicians. This was pointed out by Ascher H. Shapiro, Professor of Mechanical Engineering at M.I.T., during the Alumni Seminar: "I have the impression that physicians are well trained in chemistry as part of their medical and research education, but that their education is relatively weak in some of the hard sciences that engineers use." And he went on to list subjects such as physics, particularly mechanical and electrical phenomena, as well as certain applied sciences—mass transport processes, heat transfer, fluid mechanics, electrical circuitry, electrical fields, and membrane phenomena.

But Professor Shapiro said the differences go beyond expertise and knowledge. Physicians and engineers have different "styles of thought" so that they even

approach problems differently. In general terms, we might say that engineers learn the techniques and equations for solving problems in the physical sciences. Physicians, on the other hand, have to be exposed to dozens of patients before they develop the faculty for telling that something is wrong. A doctor, now a technologist himself, told me recently how irritated he was with a professor in medical school when the professor said of a certain condition, "and the patient looks sick." The student wanted to ask, "*How* does he look when he looks sick?" But after he had seen enough patients himself he knew what his professor meant—and yet he could not put it into words, either.

Communications continue to break down even when products are on the market. A practicing anesthesiologist from Montana told me how anxious he was to learn about new approaches that might shorten his exhausting work week, which sometimes topped 100 hours. But he frequently found himself stymied by pages of figures, or source-and-sink equations, in articles or publications about new products. This sort of thing quickly turned him off, he said testily.

Engineers may resent the fact that doctors tell what they want and what they think is needed. But engineers may have to make some accommodation to this if bioengineering is to succeed. Marketable equipment is going to have to be accepted by medical personnel and (many times) their patients. Furthermore, physicians have the burden of legal and financial responsibility for medical care. They may be held accountable for malpractice when diagnosis or treatment are carried out by others only somewhat loosely under their jurisdiction.

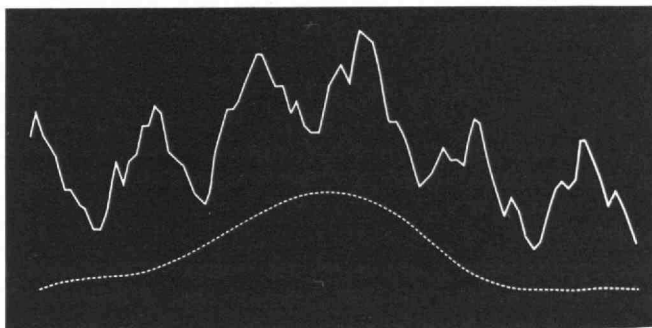
A fruitful alternative is for physical scientists or engineers to become biological scientists in some areas themselves, while retaining their mastery of physical science. Professor Shapiro and his associates have discovered how profitable this can be in the course of their recent work on ureteral function (the ureters carry urine from the kidneys to the bladder).

Their studies involve the application of fluid mechanics, and their work revealed some marked deficiencies in the physiological knowledge of ureteral function. "We are now in a better position than trained physiologists to decide what is the next experimental study to be undertaken," Professor Shapiro said. "A biomedical engineer in certain areas may be just as competent or even more competent than a medical researcher to decide what ought to be done next, and what questions ought to be asked."

Design of specific devices may represent one end of the biomedical engineering spectrum, and basic physiology the other. In between these extremes there are many opportunities for different degrees of collaboration, Professor Shapiro said.

Some physicians involved in research get carried away with their own self-importance, of course. But the best realize their own limitations and try to make collaboration possible. Dr. Selikoff is one of these.

Electrocardiography was one of the earliest applications of electrical technology to physiological research and clinical practice, and computer analysis of the complex waveforms in electrocardiograms is now relatively routine. For example, the dotted ECG signal resulted from noise filtering techniques applied to the complex P wave shown above it. (Diagram: Circulation Research from Segal and Kilpatrick, Engineering in the Practice of Medicine)



"Dialogue between physicians and engineers is simply not enough," he told his audience. "Rather than talk together, we're going to have to live together. *You* can't tell *us* what we want or need. And, unfortunately, we don't know what we want or should want."

An Engineer in the House

Research at Mt. Sinai illustrates this quandary and its solution. An electronics engineer came up with two approaches that solved a major research problem: how to isolate and then analyze submicron particles of an environmental pollutant absorbed by human tissue. Both were applications of new technology, one from the space program, another from industry.

The problem involved asbestos. A layman would probably think that exposure to this material would be limited. A few construction workers might risk inhaling it, but the rest of us would not be affected. The Mt. Sinai researchers proved that the risk is much greater and involves a large share of the population. Practically all the workers on a building project will be exposed to asbestos when it is being applied to steel beams, for example, because it is sprayed on. But then a lot of the spray goes off into the air, too, so that it is carried blocks away from new buildings and even ends up on the clothing of passers-by.

Actually, asbestos exposure is a serious health hazard. In a series of 3,000 autopsies in New York, asbestos particles were found in the lungs of half the individuals. And heavy exposure, of the kind asbestos workers get, multiplies the incidence of lung cancer several times.

But the extent of exposure in the general population could not be demonstrated until the electronics engi-

neer in the Mt. Sinai laboratory made his contributions. Before that it was extremely difficult to find particles in lung tissue. The particles are less than a micron in size, and simply do not show up well in tissue examples.

The engineer found a possible solution described in his professional literature. A firm had developed a device that destroyed organic material but left inorganic material intact. The gear was being used in the study of dust samples collected by space probes. The equipment activated oxygen in an r-f field, producing atomic oxygen. This was then used to oxidize, or ash, the organic material without destroying inorganic substances. The Mt. Sinai researchers were able to adapt this for their work, and found it did the job. The excess lung tissue could be ashed with oxygen, and the asbestos fibers survived.

But then it was necessary to apply analytical chemistry techniques to the fibers. Standard procedures worked if you had a gram—or even one-quarter gram—to work with, but these were single fibers. The engineer knew, however, that industry was using electronic microprobes for such work, particularly in metallurgy, and that these probes had sufficient resolution to deal with 0.1 micron particles. Use of this technique made possible the necessary microchemical analysis.

"We were able to take advantage of advances in the physical sciences," Dr. Selikoff said, "precisely because we had an electronics engineer as part of our team—not as a consultant—working with us every day. When he joined us, we didn't even have the faintest hint that the areas in which he was later able to help us were ones we were going to ask him about."

The laboratory also came up with three other applications of technology to reduce environmental exposure to asbestos. One involved a silicone spray to keep fibers from coming off from asbestos pipe insulation. A second called for exhaust fans on saws used to cut asbestos insulation. A third reduced fiber dispersal from asbestos cement by having water mixed in the bag before—instead of after—the cement was poured out.

"These were three straightforward engineering problems that had been with us for 40 years," Dr. Selikoff said. "But we had only medical men looking at the problems. There was nothing we worked out that could not have been worked out 40 years ago." These problems were solved by a chemical engineer, a biophysicist, and an industrial hygiene engineer—again, full-time staff members, working as a team.

Dr. Selikoff believes that two steps would greatly accelerate the application of technology to medicine. The first is, obviously, having engineers as full-time members of the research team. The second is taking a problem-oriented approach. Industry is wrong to say, "Look at the approach I have. I've got two patents on this equipment—what else can I use it for?" Instead, companies should assign engineers to specific departments in hospitals and medical schools for three or four years. "Then they'll have somebody who knows what our prob-

lems are. If nothing else, that would be useful to them."

Two quick examples:

If engineers could help develop "a method or an instrument to tell where gastrointestinal bleeding was occurring, or even when it stopped, there wouldn't be a hospital in the country without one. That's a real problem."

The New York City Health Commissioner is stymied in efforts to combat lead poisoning because there is no sensitive method for detecting the presence of lead in the body. Present techniques require 3 to 5 cu. cm. of blood. This is obviously unsatisfactory for testing a nine-month-old baby who may have eaten some paint or for mass screening of New Yorkers to find out how much lead they absorb while breathing city air.

Dr. Selikoff feels that if industry knew how to solve medicine's problems, it would sell plenty of instruments. If that is so, then the remaining two problem areas would probably be taken care of as well.

The Small Market Problem

Although there are fantastic unmet technological needs in medicine, there is no mass market of the sort that appeals to business leaders. It is a low-volume, high-unit-cost sort of business. An engineer summarized this problem area neatly when he said, "Almost anything the physician wants to do can be done—if you don't put a price on it!" This is one reason why potential products go unsold. If they cost too much the doctors will not buy them, even though they do a job.

In order to reduce costs and accelerate progress, it has been suggested that the federal government must play a larger role in the development of new medical devices. This argument was voiced again last winter. Writing in *Science*, Professors Robert F. Rushmer and Lee L. Huntsman of the University of Washington said, "One essential ingredient must be the grant and contract support by federal government of prototype development to the stage where evaluations and demonstrations can provide convincing evidence of effectiveness and marketability."

Safety, Simplicity, Durability

Dr. Roger Egeberg, the top physician in the Department of Health, Education and Welfare, has a terrible story to tell about the hazards of medical equipment. When he was an intern he was nearly electrocuted while conducting an X-ray examination. He had his arm on the metal table holding the patient; when the power went on, current went through him instead of the X-ray tube. He went into convulsions and woke up on the floor. That was more than a decade before World War II, but mishaps still take place today.

Accidents have occurred with almost every sort of electrical device used to diagnose or treat heart disease, for example. Certain commercial equipment does not meet obvious safety standards. A commercial instrument used to feed in electrocardiogram data for interpretation required 18 modifications before it could be used at the University of Missouri School of Medicine—and the first

was to ground the device.

But not all the difficulties are electrical. Here are some examples cited by Dr. Egeberg in a recent speech: "artificial heart valves manufactured with surface defects leading to excessive clot production and propagation; malfunctions of artificial kidney machines leaving patients receiving distilled water intravenously; hip prostheses having mechanical disruption so severe that tissue reaction necessitated correction by additional surgery; metal implants of various kinds that break or become corroded."

Safety, then, is a central issue in the application of technology to medicine. The federal government is trying to develop guidelines that will protect the public but still not stifle industry's initiative. The Food and Drug Administration has certain limited authorities here; but a federal committee is preparing new recommendations which are scheduled to be presented to President Nixon this spring.

Immediate physical dangers of technology are not the only ones to be concerned about, however. Bad data can be almost as serious a problem. Practicing physicians and others familiar with hospitals will tell you that many people responsible for operating equipment do not understand how to use it properly. They are unable to calibrate some devices, and they do not always know what sort of results to expect. The consequence can be misinformation treated as if it were reliable information.

Simplicity and durability of equipment are just as important as safety—and often contribute to it. Many devices are designed to be used by trained personnel: if not physicians, then nurses or technicians. But with the turnover and regular shortages of skilled staff, trained personnel are not always on duty, so less skilled help often has to be utilized. Maintenance is also a critical problem. Equipment that breaks down regularly may be worse than useless in many situations.

The mere presence of skilled personnel does not necessarily mean that equipment will be used properly, either. Dr. George Burch of the Tulane University Medical School told the San Francisco conference that he was making hospital rounds one day and noticed an electrode that had slipped off a patient whose heartbeat was being monitored. One of the doctors with him started to put the electrode back, but Dr. Burch told him to wait. It was 4½ minutes before a nurse came to reconnect the device. If the patient's heart had really been stopped, he would have been dead before the nurse reached his side.

Progress Will Be Slower

This has been a long and serious disclaimer, but it is necessary to provide the proper perspective on the role of technology in medicine. Patient care will undoubtedly become increasingly dependent upon technology. But progress will certainly be slower than the optimists would like everyone to think.

This is neatly illustrated by Dr. G. Octo Barnett's mention in this issue of four areas where "computer tech-

nology has already had an impact on the medical system." Ironically, three of these are still among the first to be mentioned when you ask a biomedical specialist (physician or engineer) to predict where technology will most influence medicine in the future.

There is a further irony in the fact that in one of these areas it is still uncertain whether technology is making a measurable difference in care, and the other two will require continued development before they come close to fulfilling their promise. These three areas are patient monitoring, automated clinical laboratories, and hospital information systems.

Patient monitoring means constant surveillance of certain physiological parameters with instrumentation. The most widely accepted equipment is used in special intensive-care units for coronary patients, but monitoring can be utilized for those recovering from other life-threatening medical conditions or from major surgery. One of the leading manufacturers of monitoring equipment feels that any real strides in therapy are going to come in this area. "Those seriously concerned about saving lives in intensive-care units do so, and instrumentation is a help," the company president said. The statistical evidence that coronary care units actually reduce mortality is at best only slightly suggestive, however. An appraisal, soon to be published, of such units in nine metropolitan hospitals indicates they make no difference one way or the other.

In certain medical centers computers are being tied into monitoring systems, and these more sophisticated combinations may be useful if they provide information that physicians need and cannot get otherwise. However, these systems are very expensive, and this could limit their availability (although minicomputers may reduce the costs substantially).

Automated clinical laboratories are usually misnamed. Most of them are not automated at all, but are highly mechanized. Mechanization is improving the performance of hospital and commercial laboratories, and will continue to do so. Two new examples are: analytical centrifuges able to measure specimens, introduce and mix reagents, and print out the results of 50 tests at a time; and a device to cultivate, isolate and type species of bacteria. To date, however, computers have been used principally to reduce errors in paperwork by handling orders, work lists, test calculations, and print-outs. Real automation, in the sense that the computer monitors and controls details of the test performance, has barely begun.

Several major corporations invested up to \$10 million apiece during the 1960's in an attempt to devise a computer system that would satisfactorily handle the flow of information necessary for patient care in a hospital. This would include patient identification, doctors' orders, nurses' instructions, pharmacy and laboratory work lists and requisitions, dietary orders, patient charts, and patient billing.

Today only one corporation has what appears to be a workable system ready to market, but even this is still

undergoing continued adaptation. Information processing of this sort could reduce the operating costs of a 250-bed hospital by nearly \$350,000 a year, according to one estimate. And yet hospital information systems are just now reaching the stage where they justify more than experimental installations.

What Will Technology Contribute?

Even after decades of development, it is still difficult to predict what technology will ultimately contribute to medical care in the United States. There are countless possibilities, starting with computer systems to help the doctor get the patient's history, choose between related diagnoses, or supervise therapy as the patient's condition changes. The possibilities extend to new developments in metallurgy and plastics, for improved implant materials; and in thermography or ultrasonics, for producing images of soft tissues now difficult to visualize or for correcting presently untreatable lesions in the brain. Some of these will prove useful, some may not.

But since there has been such a lag in the delivery of technological benefits, perhaps this is a good time for medicine, universities, industry, government, and the public to take a fresh look at what technology *ought* to contribute to patient care. There are some obvious questions which all of us may have been too busy to pay enough attention to before:

Is technology bringing better care to more people, or is it just bringing more complex medicine to a relative few?

Can technology be used to spread the benefits of today's medicine to those now out of its reach?

Can technology be used to reduce drastically today's excessive medical costs?

Ingenuity in devising systems that could provide a firm "yes" in answer to those last two questions would contribute far more than much of the electronic gadgetry now so proudly demonstrated at biomedical engineering meetings.

In the meantime, here is another question. During a "problem clinic" at the San Francisco conference on electronics in medicine, one man said something that should give all technologists pause. "As an engineer," he announced, "I'd rather have the opinion of two competent doctors than two competent computers."

The question that keeps coming back to me is, Did he mean it?

Samuel Moffat is a free-lance writer specializing in medical topics based in Palo Alto, Calif. His career began as a reporter on the Palo Alto Times; after a year in the advanced science writing program at Columbia University (1958-59) he became Information Officer for the Stanford University Medical Center (1959-66). He is co-author, with Drs. Elie A. Shneour and Joshua Lederberg, of Life Beyond the Earth (1965).

BECKER ENTRE-CAPITAL

The primary objective of BEC is to arrange the private purchase of established businesses, select outstanding management-entrepreneurs to transform them into highly profitable enterprises and, at an appropriate time, foster their growth and expansion through public ownership.

The man with a record of managing a sizeable business (minimum \$10 million sales), who is motivated by an important ownership stake, the prospect of significant capital gain, and the excitement of building a successful business, will want to become acquainted with BEC.

Michael J. O'Reilly, Vice President (HBS '57)

A. G. Becker & Co. Incorporated

60 Broad Street, New York, New York 10004

Telephone: 212/363-2800

will welcome the opportunity to discuss BEC with you in complete confidence.

A.G. Becker & Co.

INCORPORATED

Members New York Stock Exchange and other principal stock exchanges

FLEXITUBE... the unique off-set tube (Steam Heating Coils) with built-in insurance against differential expansion trouble

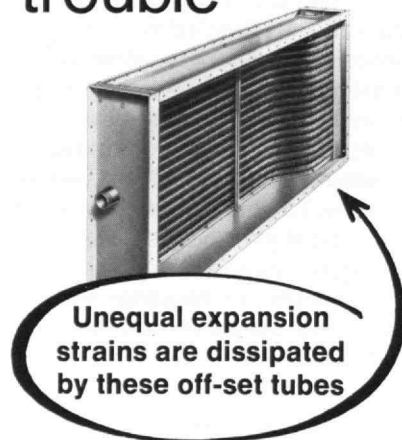
Aerofin's Flexitube heating coil design has proven itself on job after job for over 30 years.

Flexitube looks different — performs differently. The unconventional off-set tube imparts a genuine flexibility, permitting temperature change expansion or contraction — without strain on the tube, header/header joints, or the casing.

In built-up heating systems where differential expansion (due to air

stratification and air binding within the tube) causes some tubes to be hotter than others, this unequal expansion breeds stresses and even ruptures. *Flexitube handles such mechanical stresses in stride, safely.*

Flexitube's single-pass, header-to-header design also contributes to absorption of stress and strains, since it insures *uniform* steam distribution and proper, quiet drainage of condensate.



Aerofin's Flexitube will stand up against differential expansion for middle range and low pressure service—indefinitely. Who else can make that heating coil statement?

SPECIFY FLEXITUBE FOR EXTRA SAFETY where large coil expansion/contraction might be a problem.

Flexible is but one of a broad line of Aerofin heating and cooling coils.

AEROFIN

CORPORATION • LYNCHBURG, VIRGINIA 24505

Aerofin is sold only by manufacturers of fan system apparatus. List on request.

AEROFIN OFFICES: Atlanta • Boston • Chicago • Cleveland • Dallas • New York • Philadelphia • San Francisco • Toronto • Montreal
AEROFIN CORPORATION (CANADA) LTD., Gananoque, Ontario

Fight fire with fire prevention

Fire prevention and fire insurance go together.
In fact, at Arkwright-Boston, we encourage one
along with the other.

We stress property conservation: careful house-
keeping ☐ the right sprinkler system ☐ scheduled
inspections . . . and lots more.

We know that all the fire insurance in the world
can't save a building, a business, a life.

Fire prevention can.

ARKWRIGHT-BOSTON INSURANCE

Executive offices: 225 Wyman St., Waltham, MA 02154
Arkwright-Boston Manufacturers Mutual Insurance Company
Mutual Boiler and Machinery Insurance Company
Factory Mutual Insurance



Offices in major cities throughout the United States and Canada





we present
THE INDISPENSABLE BLAZER
TAILORED OF EXCLUSIVE BROOKS-KNIT

Brooks-Knit is a blend of polyester and worsted developed for us by a noted French knitting mill. In appearance it differs only slightly from a woven cloth... but it performs as only a knitted fabric will: stretching at points of stress for extraordinary comfort, and defying wrinkling and crushing to an amazing extent. We have tailored Brooks-Knit on our classic blazer with welted edges and brass buttons. In navy. \$125

We also offer Brooks-Knit in our own make suits in oxford grey or navy. Coat, vest and trousers, \$185

ESTABLISHED 1818

Brooks Brothers
CLOTHING
Mens & Boys' Furnishings, Hats & Shoes

346 MADISON AVE., COR. 44TH ST., NEW YORK, N.Y. 10017
 46 NEWBURY, COR. BERKELEY, BOSTON, MASS. 02116
 600 SMITHFIELD AT MELLON, PITTSBURGH, PA. 15222
 ATLANTA • CHICAGO • LOS ANGELES • SAN FRANCISCO • SCARSDALE • WASHINGTON

The greatest ad in the world is a waste of money...

unless the right people read it!

To be effective, your ads must be read by the people you need to reach, in media that selects your market for you. You and 90,000 other Harvard and MIT alumni are now reading one such medium: a member of The Cambridge Alumni Group.

This uniquely selective combination of magazines — Harvard Alumni Bulletin, Harvard Business School Bulletin and Technology Review — is dedicated to the special interests of the nation's most influential leaders, commanding their constant, concentrated attention — cover to cover, month after month.

Your ads earn money here. If you want to reach the right people, in the right place, at the right price — avoid the wasteland. Put your message where it counts: in The Cambridge Alumni Group. **THE EDUCATED BUY.**



Free brochure describing the personal and corporate buying patterns of 90,000 of the nation's most influential readers simply, effectively, economically.

Phone (617) 542-7720 for your copy,
or send coupon to:
MediaRep Center Inc.
1127 Statler Office Building
Boston, Massachusetts 02116

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

Trend of Affairs

For the Preservation of Bottlenecks

"As I have looked at solutions that people offer for various problems facing us, I notice that they all have the same feature in common. Whenever one can identify some aspect of the problem that is holding back progress—that is, whenever one can isolate a *bottleneck*—the universal conclusion seems to be that the bottleneck should be eliminated and all will be right.

"Unfortunately, whether one is talking about traffic, education, or what have you, it just doesn't work that way," writes Dr. William H. Huggins in *I.E.E. Student Journal* (Vol. 8, No. 1, pp. 48-52). Dr. Huggins—the doctorate is for electrical engineering, from M.I.T.—is Westinghouse Professor at Johns Hopkins, a consultant to the Rand Corporation, and holds the Air Force Decoration for Exceptional Civilian Service. He observes that when one bottleneck is removed, "several other bottlenecks suddenly spring into existence." And he argues that "a much more effective way for solving many of our problems would be to insert a few well-chosen bottlenecks into the system."

His reasoning comes from feedback theory. One of the most important results in feedback theory, he says, is that the slower parts of a system are important, provided that they are few. The best overall quality of performance is to be expected if a system contains just one relatively slow-reacting subsystem, in comparison with which all the other parts respond quickly. Not only do the absolute speeds of the subsystems affect the overall performance: so do their *relative* speeds.

Thus, speeding up the slowest subsystem—removing the bottleneck—will result in the next-slowest ones taking over as bottlenecks. If there are a number of them, of comparable speeds, the system may now behave worse than before, possibly going unstable. "An improved performance can often be achieved by *inserting bottlenecks* to deliberately slow down some part of the system so that the rest of the system will be quick, responsive, and adequate."

Dr. Huggins ends with a piece of advice for the designers of systems involving people. The time-scale of

changes in people is about one generation. The machines with which people are supposed to interact have very much shorter time-scales, and the tendency is to speed them up even further. If we attempt to change people faster than their inherent time-scale allows, "serious distortions and other anomalies arise. Certainly, it must be necessary to incorporate the human time-scale in the design of the system of which he is a part. As we employ the elements and devices of our technology to speed up everything else, the human being becomes a less creative part of the system because he cannot cope with the response speeds that it demands.

"Of course rather than be shunted aside and controlled by the system, he may assert his role as a bottleneck and attempt to slow it down. That is why we need a Society for the Preservation of Bottlenecks!"

Towards an Intercity Transport Vehicle

One possibility for intercity transport is a train, running on the tracks that already exist but taking a significantly shorter time between terminals than present-day trains. It would, of course, have to give the passenger (in the words of S. Jones, of the British Railways Board) "a smooth, quiet and comfortable ride, and amenities and decor in keeping with the growing standards of material comfort available in general to the public."

The main difference between such a train and those we have today lies in the design of the wheels and the suspension system, writes Jones (*Nature*, Vol. 225, pp. 417-419). The vehicle must not "hunt" from side to side; objectionable frequencies of motion must not be transmitted to the passenger; and the vehicle must be able to take a given curve appreciably faster than could the trains for which the track was originally laid.

The above is essentially a feedback problem. Jones points out that defense work, during and since the Second World War, has markedly improved our ability to solve such problems. Nevertheless, the British Railways team which was set up for this purpose seven years ago encountered considerable difficulties, due to the

A cybernetic view of natural systems controlling themselves with feedback mechanisms is offered by Werner Stumm of the Harvard Division of Engineering and Applied Science; pollution is defined as an uncontrolled change in such a system. Unpolluted systems show gradually-increasing diversity and complexity and decreasing energy flow; a system may be considered polluted when any of these parameters trend in the wrong direction, Dr. Stumm told the American Chemical Society this winter.

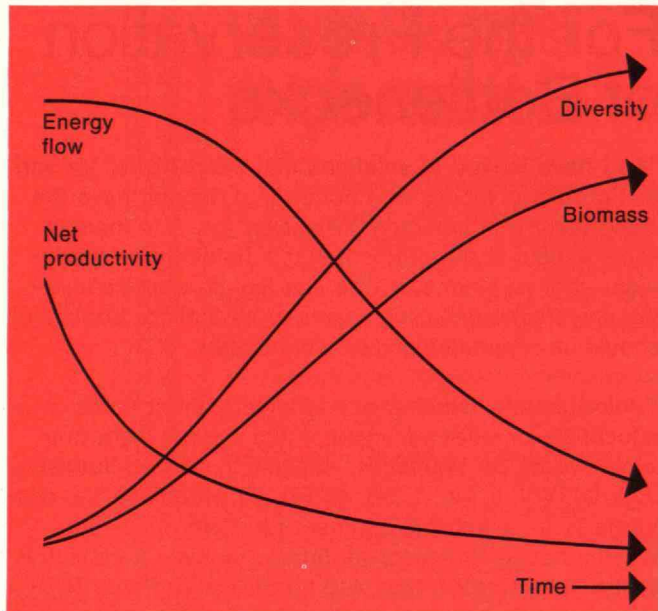
many degrees of freedom of a rail vehicle and "the gross non-linearities that are present."

But the team has now reached the point where the dynamic behavior of rail vehicles can be predicted. Close agreement between theory and observation has been achieved with a series of test vehicles running on track at up to 100 mi./h. and on a track simulator (using rollers) at up to 140 mi./h. The wheels of these vehicles are designed so that, as they wear down, their profile remains close to design. (If the cone-angle of the wheel's surface is large, guidance is good but with a tendency to dynamic instability at low speeds; if it is too shallow, guidance is poor and begins to rely on the wheel-flanges.)

A train has now been designed—with the registered name Advanced Passenger Train—for stable running at up to 150 mi./h, with a "design stretch" to 200 mi./h. The suspension is designed specifically to handle British track, and "to run without flange contact on all curves on the main lines of British railways."

To minimize lateral accelerations felt by the passengers on curves of rapidly changing radius, an active hydraulic system is incorporated which senses lateral forces and tilts the vehicle accordingly. Rapid acceleration is achieved by cutting down the weight of the train to the limit imposed by side-wind forces. Power is provided by gas turbines, adding up to a nominal total of 2,400 h.p. for a six-passenger-car train. Braking will be hydro-kinetic. The ultimate limitation on braking—adhesion between wheels and rail—should be pushed back as a result of the stable suspension system, but in addition a plasma torch is being developed to clean the rail surface ahead of the wheels. An experimental version of the train should be running by next year, and commercial service should begin in 1974.

"The attraction of the advanced passenger train is that it offers a fuller exploitation of the existing rail network of a good modern railway system with little or no additional investment in track," Jones concludes. "This is the reason for interest in the possibility of licensing the train abroad." Finally, he notes that speeds of around 300 mi./h. are technically feasible "along tracks which are not incompatible with much of the existing track and with many of the existing main line railway stations," if this is in line with public policy and amenity.



Pollution Cybernetics

Pollution: everyone talks about it, but who knows what it really is? Not impurity, because who knows what was the "pure" state? Not algae, or biologicals, or minerals, because water has always held plants, animals, and the salts of the oceans. Not man's products, because man and his precursors have been a "natural" part of Earth's environment for eons.

The test for pollution is instability, Werner Stumm of the Harvard Division of Engineering and Applied Science told the American Chemical Society in Houston this winter. "The non-polluted environment is one which resists perturbation," he said. "Integrating over our world, we have a remarkably steady-state system—a constant balance between heat loss and gain, in the chemical composition of the oceans, between predators and prey. Pollution may be interpreted as a disturbance of such a steady state."

Like most steady states, those in nature are controlled by feedback loops. Living things control themselves—predators increase as their prey increases. Maintaining the balance of heat and energy in the ocean—or in the atmosphere—requires a vastly complex system of feed-

back and control loops. In lakes, feedback controls relate the rate of photosynthesis to the rate of respiration, the balance between nitrogen and phosphorus.

Seen in this way, an unpolluted ecological system is not necessarily an unchanging one; it is simply a system in which the cycling is controlled, not running out of control; in which energy flows are decreasing, not increasing; in which systems are developing increasingly complex checks and balances; in which diversification is increasing; in which instability is giving way to stability.

Dr. Stumm thinks this broad, "cybernetic" view of pollution holds the best promise for man's effective management of his environment. For example, he said, "water pollution control does not consist solely of waste treatment; various physical and biological means of stream management may be directed towards restoring an ecological balance desirable for man."

Over the Rainbow in Two Milliseconds

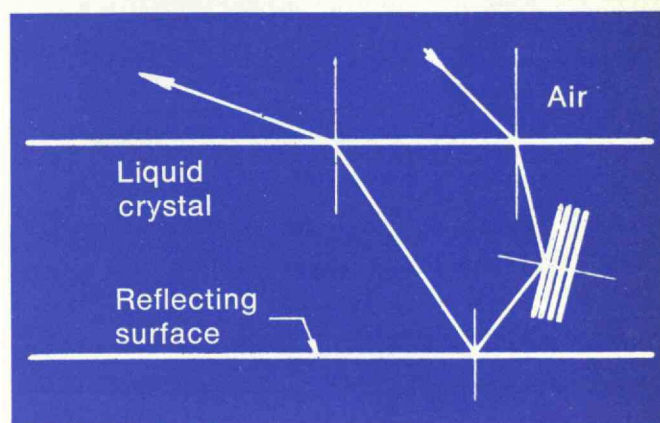
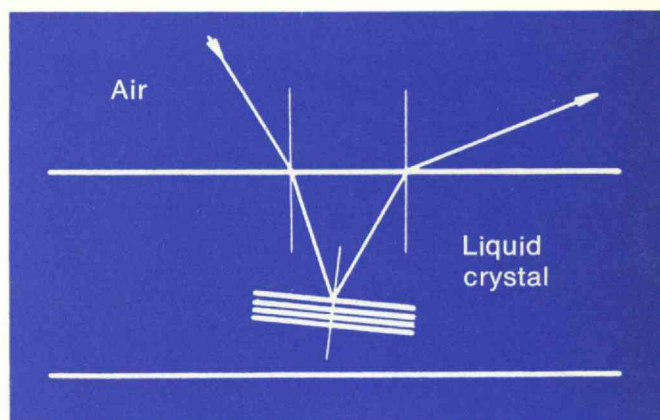
Certain liquids have crystal-like molecular structures, and so are known as liquid crystals. Crystals in general exhibit "Bragg" reflection, a wavelength-discriminating interference effect—although at wavelengths shorter than that of visible light. In a liquid crystal, the periodicity of the structure can be sufficiently large to separate the wavelengths of visible light. Frederic J. Kahn, now at Bell Telephone Laboratories, has developed (while working for Nippon Electric Company) a liquid-crystal system whose color can be swept through the visible spectrum in one or two milliseconds.

The liquid is of the type known as cholesteric—that is, composed of compounds containing cholesterol. Rapid full-spectrum color changes have already been demonstrated in such a liquid, but Kahn believes that his effect works an order of magnitude faster than the previously reported one, and that his is the first such color-change that has been accounted for quantitatively.

The new system also has one other peculiarity. The colored output-beam is directed back along the path of the obliquely incident light, rather than being "reflected" forward, mirror-fashion. This difference arises because the layers of molecules in the liquid crystal—ordinarily arranged parallel to the surface—flip over into a perpendicular orientation when a certain critical electric field is applied. If the liquid is resting on a mirror surface, incident light then undergoes two reflections, one from the mirror and one from the crystal planes roughly at right angles to it.

The critical voltage-gradient is in the region of 10^4 V./cm. Although the flipover which occurs at this field strength takes some time—of the order of minutes—once it is accomplished the color of the liquid can be changed by further increasing the voltage in one or two milliseconds.

The first diagram shows Bragg reflection from cholesteric liquid crystals, as it is normally observed. The spacing between the crystal planes governs which colors are reinforced in the reflected light. The second diagram depicts the situation where the crystal structure is rotated through roughly 90° by an applied field. By further altering the field strength, the lattice spacing and hence color can be altered very rapidly.

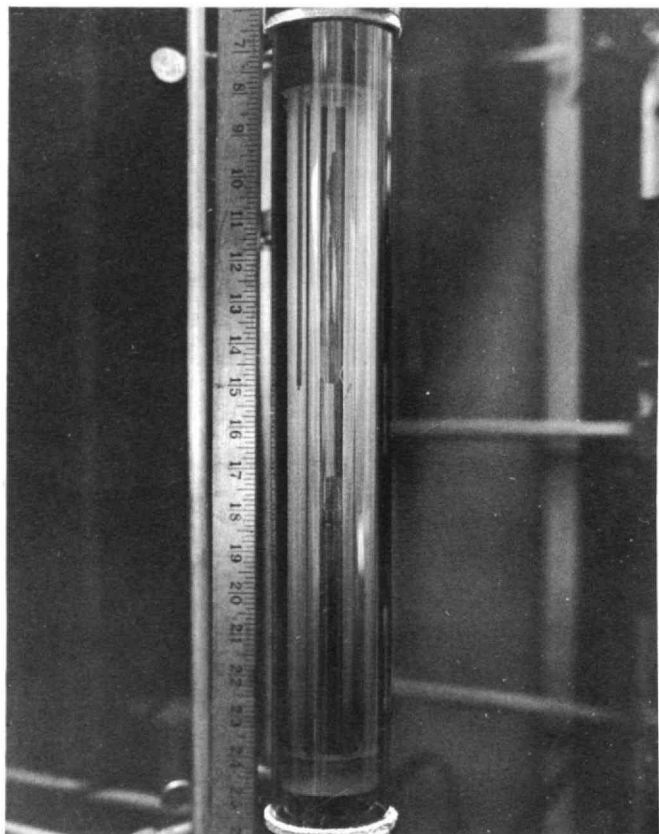


Climate: On Predicting the Unpredictable

Everyone understands that the earth's climate changes, that glaciers which once covered much of the Northern Hemisphere have receded, that lands once tropical are now temperate. But no one knows why.

Speakers at a special session of the American Association for the Advancement of Science in Boston this winter (cosponsored by the American Meteorological Society) explored the problem in some detail. They agreed that climate is a dynamic, complex system of interdependent variables which may ultimately defy understanding and almost surely will defy prediction.

A transparent furnace, developed by Dr. Thomas Reed of M.I.T.'s Lincoln Laboratory, operates at 1,200°C with a power consumption similar to that of a conventionally insulated furnace. The only heat-screening is a very thin gold film.



Terrestrial and astronomical factors are both involved; J. Murray Mitchell, Jr., of the Environmental Science Services Administration, listed some of them: small fluctuations in the position and radiation of the sun (there is a two-week variation of about 0.1 per cent in solar radiation); changes in continents and land forms, some induced by changes in sea level which themselves are induced by climatic change; changes in weather and winds (there has been a systematic drift eastward of pressure systems in the Atlantic Ocean, now apparently being reversed); changes in ocean currents and heat flow between ocean and atmosphere; changes in ocean salinity which affects ocean overturn and therefore the heat budget of the seas.

Upon such factors as these are now superimposed the effects of man, who "is emerging as a very potent geophysical force," said Dr. Mitchell. He referred to changes in the earth's surface texture and color, transparency of the atmosphere, and flow of heat through de-

velopment and pollution. (Another seminar speaker, Helmut E. Landsberg of the University of Maryland, said atmospheric changes caused by urbanization "require closest surveillance to prevent ecological catastrophes.") Indeed, by superimposing man-made upon natural change, said Dr. Mitchell, man is adding so many difficulties that natural climatic change may never be understood at all.

Still another complication was raised by Erik Eriksson of the University of Stockholm Institute of Meteorology, who pointed out that the earth in fact is seldom in the condition of climatic mean. Climate is constantly varying around the average. "I doubt very much if we can assess by numerical methods the effect of any single variable in such a noisy system," he said.

The twenty-first century promises super-computers, to handle the almost infinitely large number of variables which enter into climatic prediction. But Edward N. Lorenz, Professor of Meteorology at M.I.T., still was not optimistic. We may be able to program all the external changes we can observe and calculate, said Professor Lorenz, but the equations governing the atmosphere may in fact be unstable; climatic change may be governed internally as well as externally.

Two Cents in Gold Keeps the Heat In

The idea of a transparent furnace seems at first sight to be almost self-contradictory. One thinks of furnaces as being heavily screened to prevent the heat from escaping. But at M.I.T.'s Lincoln Laboratory a 1,200° C. furnace has been developed in which the contents are as visible as if they were out in the room.

It consists essentially of nine alumina tubes, bearing the heating wires, surrounded by a 2½-in.-diameter Pyrex tube lined with a thin layer of gold. It was developed by Dr. Thomas B. Reed, initially for watching the growth of crystals condensing from the vapor state. In the past, windows had been added to conventional furnaces for viewing crystal growth. The trouble was, all growth would occur on the window, the coolest part of the furnace, where infrared radiation leaked out along with the visible light.

Dr. Reed found that gold metal, when sufficiently thin, transmits visible light but still reflects about 95 per cent of the infrared radiation carrying most of the energy. To make a practical furnace, a 200-Å layer of gold (about 0.013 g., costing about two cents) was evaporated on to the inside surface of a Pyrex tube and a simple resistance heating element placed inside. This furnace achieves temperatures up to 1,200° C. at powers comparable with what a conventionally insulated furnace needs. Thus, it can be said that 200 Å of gold has about the same insulating value as 3 inches of asbestos.

The gold furnace has proved to be ideal for crystal

growth from vapor, and crystals of zinc telluride (ZnTe, a photoconducting semiconductor) an inch long have been grown in it. Other Lincoln workers are using the furnace to measure high-temperature vapor pressures. In addition to being transparent, the thin insulation makes the furnace very compact, and another member of the laboratory uses it to observe high-temperature electrical behavior inside a high-field magnet.

The furnace is also a great time saver—with its low mass (and thus low heat capacity) it can be heated up in 15 minutes and cooled back to room temperature in 30 minutes, compared to four hours for a conventional muffle furnace. It once saved Dr. Reed a whole week: seeing, after the first hour of a week-long run on ZnTe, that the internal seed crystal had been dislodged, he was able to cool the furnace, remount the seed, and return to temperature in less than two hours. It has also been found very easy to measure the relative temperatures of all objects in the furnace using an optical pyrometer, since the gold layer simply introduces a correction factor which is the same at all points. Indeed, the temperature itself can be made uniform over an unusually long tube length, owing to the reduced end losses. Finally, being simple, the gold-lined furnace is inherently inexpensive.

Africa to Caribbean

Does African dust spawn Caribbean hurricanes?

Joseph M. Prospero of the Institute of Marine and Atmospheric Sciences at the University of Miami does not propose simple cause-and-effect, but he is willing to speculate. The dust, he says, is clearly present.

Dr. Prospero and his associates have been sampling air in the trade winds of Barbados, most easterly of the Caribbean islands, for four years. The dust load in this air, he told a meeting of the American Chemical Society in Houston, is "average for a suburban area"—5 to 6 $\mu\text{g./cu. m.}$ of air—but sometimes rises to much higher levels—as much as 26 $\mu\text{g./cu.m.}$

Analysis reveals that aerosols carried to Barbados by the Atlantic trade winds contain more continental than oceanic material; the major constituent is quartz, but there is a "good average sample" of crustal abundances, Dr. Prospero told the A.C.S. Except for abnormal quantities of lead, zinc, and tin, there is little evidence of pollution; these mineral constituents are believed by Dr. Prospero and his colleagues to result from circulation which brings air from the U.S. industrial northeast into the region of the Azores, from whence it returns to the Caribbean.

The size of dust particles in Barbados air correlates with weather conditions over the Atlantic, the quantity with dust storm conditions on the African continent. For example, on July 3, 1969, six days after a severe African dust storm, Dr. Prospero and his colleagues have calculated that 1 million metric tons of dust descended upon the Caribbean region.

Craig S. Tedmon, Jr., of the General Electric Research and Development Center, Schenectady, with his red-hot electric motor.



Electric Power At Red Heat

The search for pollution-free, compact, convenient sources of electric power has given rise to much research on fuel cells, which convert chemical energy directly into electricity. A central problem with fuel cells has been limited power per unit weight (specific power). One way out of this difficulty is to use electrolytes which are not salt solutions but instead molten salts, which have much lower resistivities. This in turn means working at temperatures well above 100° C.

One by-product of a now-terminated General Electric project in this field is shown in the photograph—an electric motor that runs at about 800° C. This is believed to be a record for electric motors. The red-hot protuberance at the top is the shaft.

No application is considered for this device. It merely

More than 60 per cent of auto damage claims on cars less than one year old in five western states between October 1, 1968, and March 31, 1969 (see chart above), were for \$200 or less. A typical modern automobile sustains damages costing between \$135 and \$300—depending on the make—to repair when crashed into a fixed barrier at 5 mi./h. Within “present engineering know-how,” Dr. William Haddon, President of the Insurance Institute for Highway Safety, told the Society of Automotive Engineers this winter, designers could keep damage at far lower levels.

demonstrates the properties of one high-temperature conductor material “in a somewhat dramatic manner,” to quote G.E.’s Craig S. Tedmon, Jr., the metallurgist who, with Thomas F. Andrus, designed and built it. The material is a silver-palladium alloy coated with nickel, which forms a protective nickel oxide film at high temperatures in air. As a simple conductor, a wire of this material functions in air at 1,200° C.

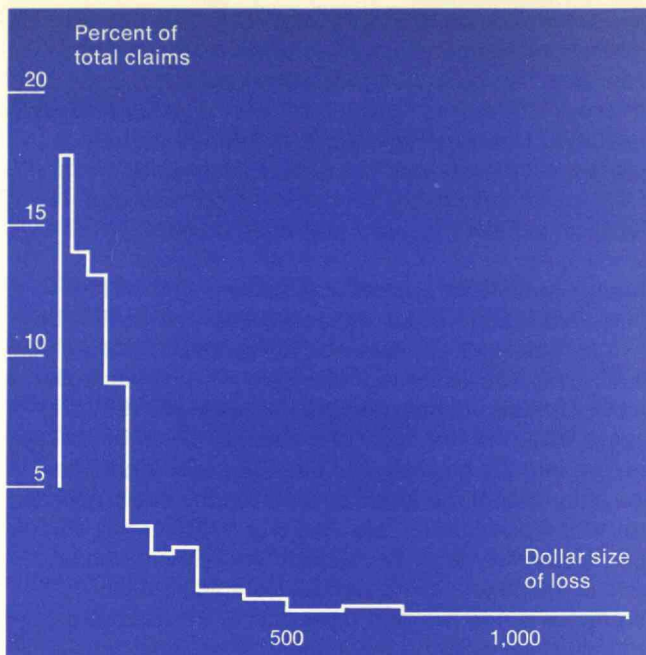
The Car as Package

Preventing automobile crashes is not enough. Indeed, as Dr. William Haddon, President of the Insurance Institute for Highway Safety, told the Society of Automotive Engineers in Detroit this winter, the “traditionally narrow” approach which emphasizes preventing crashes instead of mitigating their results “continues to consign hosts of Americans to injury and disfigurement” and imposes upon drivers “continuing billions of dollars of unnecessary property loss.”

“No industrial shipping executive would be considered either professionally competent or responsible if he only attempted to prevent untoward events and ignored packaging and salvage-when-damaged activities,” Dr. Haddon told the S.A.E. “Yet this is precisely the equivalent of what has largely served as ‘highway safety’ during six decades of mounting highway losses,” he said. Reducing these “appalling” losses is “one of our nation’s most urgent ecological problems.”

It requires the three-way approach which Dr. Haddon pioneered as the first Director of the National Highway Safety Bureau in the Department of Transportation. There must be continued effort to reduce the frequency of crashes. But there must be new emphasis on improving the protection which vehicles provide their occupants and on making vehicles themselves less subject to damage and less expensive to repair.

Dr. Haddon told the S.A.E. that “the great tolerance—provided maximum values are not exceeded—of the properly packaged human body” to forces of transition “typical of many vehicular crashes” is well known. On the basis of such physical knowledge, he said, it should be possible to establish ratings for vehicles based on the protection they provide for “standard occupants.”



Because of modern auto design, the energy of even relatively minor crashes (in the 5-to-20 mi./h. range) results in structural, rather than superficial, damage. If an aeronautical engineer designed an airplane landing gear in which the hard bumps of landing produced structural damage, said Dr. Haddon, he would be branded as incompetent. And he suggested that the modern automobile represents a similarly “archaic engineering solution that will soon be publicly unacceptable in this country.”

A Theory on Clear-Air Turbulence

A continuing threat to high-flying aircraft is a form of turbulence which occurs in unclouded air and therefore gives no visual warning. In one recent year, clear-air turbulence (CAT) cost U.S. commercial aviation \$18 million, mostly in the expense of diverting aircraft around areas in which the turbulence had been reported or predicted. John A. Dutton and Hans A. Panofsky, meteorologists at Pennsylvania State University, now find that CAT fits a fairly simple theory, which should provide guidance for future theoretical and practical studies (*Science*, Vol. 167, pp. 937-944).

They suggest that CAT is a form of the so-called Kelvin-Helmholtz instability. This phenomenon can arise when two fluids of different density are separated by a horizontal interface, and one is moving horizontally across the other. If the vertical density difference is great enough and the horizontal “velocity shear” is small enough, vortices begin to grow “as if a tumbleweed were being rolled between two streams of air.”

The crucial relationship between density difference and velocity shear is abbreviated, by theoreticians, into a single nondimensional ratio, the Richardson number. Recent work indicates that the vortices may develop if

the Richardson number is less than $\frac{1}{4}$, and will not if it is larger. For the atmosphere, the Richardson number is directly deducible from observations of temperature, pressure, and windspeed at different points in a region. And indeed, small Richardson numbers do correlate, statistically at any rate, with regions of C A T.

Unfortunately, "the data that are regularly available are not sufficiently accurate to reveal the internal fronts where most turbulence occurs or to permit accurate evaluation of the telltale Richardson numbers. There is, however, some hope that data-processing methods can be designed to utilize the hypothesis . . . presented here in order to produce better forecasts."

Concerning present methods of detecting CAT, the authors note that none of the airborne systems—radar, lasers, or infrared temperature sensors—seem "at all promising at present," but that "some success has been demonstrated . . . with ground-based electronic equipment." They offer the hope that physical insight into the nature of CAT may enable future meteorological research programs to yield a practical solution to the problem. Meanwhile, "improved communication between pilots and meteorologists on the ground can improve the situation."

Friendly Persuasion, or Bribing the Bugs

The old and genteel technique of discouraging bad behavior by providing a more attractive alternative (frequently recommended for small children) is proving useful with the cotton pest, *Lygus hesperus*: alfalfa strips are planted in cotton fields, because *Lygus* would rather eat alfalfa. *Lygus* returns the favor by helping to control other pests by predation, the American Association for the Advancement of Science learned this winter in Boston.

These are parts of an integrated control system of pest management devised by entomologists from the University of California for use in the cotton fields of the San Joaquin valley. The system essentially seeks to disturb as little as possible the natural ecology of the field by manipulating natural biological controls for pests. Oddly enough, it seems also to be the most economic method of control, according to R. van den Bosch, of U.C., Berkeley, and his colleagues.

Since World War II, farmers in the valley had sought to control the two major pests, *Lygus*, a mirid, and *Heliothis zea*, a bollworm, by doses of the organochlorides. These proved to have an undesirable tendency to migrate, to persist, and to accumulate in the fatty tissues of warm-blooded animals. Their replacement with the organophosphates, however, was no great improvement. The organophosphates have none of these disadvantages, but neither do they last long enough after application to be as effective. Furthermore, heavy applications of either seemed to engender attacks upon the cotton by lepidopter pests and to damage the crop itself.

Integrated control is an alternative which combines cultural, biological, and chemical techniques. In 1969, when some of its parts were first tried, they proved more effective, less damaging, and less expensive than chemical means alone.

The first problem the entomologists faced was to determine what pests, and when, and how, were damaging cotton crops. This had never been clearly established. Threshold numbers of pests per plant or per net sweep at which economic loss occurred had been defined for *Lygus* and *Heliothis zea* but were found to be inaccurate. Chemicals were applied for others according to the whim of the grower, the persuasion of the salesman, or the presence of pests. A revised threshold for *Lygus* was defined, and this was perhaps the turning point of the program. It was found that the criterion used, ten bugs per fifty sweeps, was valid only if sustained over two tests four or five days apart, and then only from June 1 to July 20, when the commonly planted variety of cotton, Acala S.J. 1, is in the heavy squaring (flower budding) stage. After this period, fairly large numbers of bugs can be tolerated. It was found that *Heliothis zea* and other lepidopterous insects peaked one to two weeks after the heaviest moth flights, which in turn peaked at the dark of the moon and primarily during late July and early August. The two patterns fitted neatly together, and the entomologists advised growers to avoid chemical treatments for *Lygus* during this period, leaving to it the job of controlling the lepidopterous insects.

Growers who used this schedule in applying chemical controls during 1969 reported a low level of lepidopterous infestation. Further, it was found that these pests frequently feed on parts of the plant not harvested, so they might, at low levels, not be injurious.

Alfalfa, since *Lygus* prefers it to cotton, also provides a natural control. Strips of alfalfa 16 ft. to 32 ft. wide effectively protect 300 to 400 ft. of cotton, and the interplanting is easily accomplished. It has been used in some commercial fields and should be used more widely in the future. Microbial enemies of cotton pests may also prove successful as agents of natural control.

"A Few Will Make It"

Emotional factors—rather than a cold, hard-headed analysis of the problems and prospects—are usually behind the efforts of a black entrepreneur to buy or develop a ghetto supermarket. And so the prognosis is not very good.

"A dispassionate appraisal of the prospects for black owners of supermarkets in American ghettos can lead to only one conclusion," says Gordon F. Bloom, Senior Lecturer in the Sloan School of Management at M.I.T.: "A few will make it; most will fail."

Why make the effort? Because the supermarket has become the universal symbol of American affluence, it is the symbol of big business in the ghetto, and there is typically a critical shortage of good retail stores to

More than 60 per cent of auto damage claims on cars less than one year old in five western states between October 1, 1968, and March 31, 1969 (see chart above), were for \$200 or less. A typical modern automobile sustains damages costing between \$135 and \$300—depending on the make—to repair when crashed into a fixed barrier at 5 mi./h. Within “present engineering know-how,” Dr. William Haddon, President of the Insurance Institute for Highway Safety, told the Society of Automotive Engineers this winter, designers could keep damage at far lower levels.

demonstrates the properties of one high-temperature conductor material "in a somewhat dramatic manner," to quote G.E.'s Craig S. Tedmon, Jr., the metallurgist who, with Thomas F. Andrus, designed and built it. The material is a silver-palladium alloy coated with nickel, which forms a protective nickel oxide film at high temperatures in air. As a simple conductor, a wire of this material functions in air at 1,200° C.

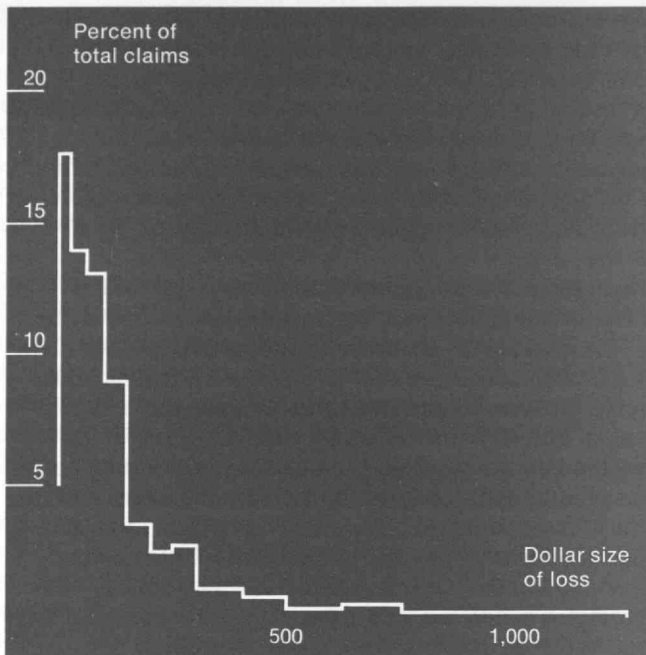
The Car as Package

Preventing automobile crashes is not enough. Indeed, as Dr. William Haddon, President of the Insurance Institute for Highway Safety, told the Society of Automotive Engineers in Detroit this winter, the "traditionally narrow" approach which emphasizes preventing crashes instead of mitigating their results "continues to consign hosts of Americans to injury and disfigurement" and imposes upon drivers "continuing billions of dollars of unnecessary property loss."

"No industrial shipping executive would be considered either professionally competent or responsible if he only attempted to prevent untoward events and ignored packaging and salvage-when-damaged activities," Dr. Haddon told the S.A.E. "Yet this is precisely the equivalent of what has largely served as 'highway safety' during six decades of mounting highway losses," he said. Reducing these "appalling" losses is "one of our nation's most urgent ecologic problems."

It requires the three-way approach which Dr. Haddon pioneered as the first Director of the National Highway Safety Bureau in the Department of Transportation. There must be continued effort to reduce the frequency of crashes. But there must be new emphasis on improving the protection which vehicles provide their occupants and on making vehicles themselves less subject to damage and less expensive to repair.

Dr. Haddon told the S.A.E. that "the great tolerance—provided maximum values are not exceeded—of the properly packaged human body" to forces of transition "typical of many vehicular crashes" is well known. On the basis of such physical knowledge, he said, it should be possible to establish ratings for vehicles based on the protection they provide for "standard occupants."



Because of modern auto design, the energy of even relatively minor crashes (in the 5-to-20 mi./h. range) results in structural, rather than superficial, damage. If an aeronautical engineer designed an airplane landing gear in which the hard bumps of landing produced structural damage, said Dr. Haddon, he would be branded as incompetent. And he suggested that the modern automobile represents a similarly "archaic engineering solution that will soon be publicly unacceptable in this country."

A Theory on Clear-Air Turbulence

A continuing threat to high-flying aircraft is a form of turbulence which occurs in unclouded air and therefore gives no visual warning. In one recent year, clear-air turbulence (CAT) cost U.S. commercial aviation \$18 million, mostly in the expense of diverting aircraft around areas in which the turbulence had been reported or predicted. John A. Dutton and Hans A. Panofsky, meteorologists at Pennsylvania State University, now find that CAT fits a fairly simple theory, which should provide guidance for future theoretical and practical studies (*Science*, Vol. 167, pp. 937-944).

They suggest that CAT is a form of the so-called Kelvin-Helmholtz instability. This phenomenon can arise when two fluids of different density are separated by a horizontal interface, and one is moving horizontally across the other. If the vertical density difference is great enough and the horizontal “velocity shear” is small enough, vortices begin to grow “as if a tumbleweed were being rolled between two streams of air.”

The crucial relationship between density difference and velocity shear is abbreviated, by theoreticians, into a single nondimensional ratio, the Richardson number. Recent work indicates that the vortices may develop if

the Richardson number is less than $\frac{1}{4}$, and will not if it is larger. For the atmosphere, the Richardson number is directly deducible from observations of temperature, pressure, and windspeed at different points in a region. And indeed, small Richardson numbers do correlate, statistically at any rate, with regions of C A T.

Unfortunately, "the data that are regularly available are not sufficiently accurate to reveal the internal fronts where most turbulence occurs or to permit accurate evaluation of the telltale Richardson numbers. There is, however, some hope that data-processing methods can be designed to utilize the hypothesis . . . presented here in order to produce better forecasts."

Concerning present methods of detecting CAT, the authors note that none of the airborne systems—radar, lasers, or infrared temperature sensors—seem "at all promising at present," but that "some success has been demonstrated . . . with ground-based electronic equipment." They offer the hope that physical insight into the nature of CAT may enable future meteorological research programs to yield a practical solution to the problem. Meanwhile, "improved communication between pilots and meteorologists on the ground can improve the situation."

Friendly Persuasion, or Bribing the Bugs

The old and genteel technique of discouraging bad behavior by providing a more attractive alternative (frequently recommended for small children) is proving useful with the cotton pest, *Lygus hesperus*: alfalfa strips are planted in cotton fields, because *Lygus* would rather eat alfalfa. *Lygus* returns the favor by helping to control other pests by predation, the American Association for the Advancement of Science learned this winter in Boston.

These are parts of an integrated control system of pest management devised by entomologists from the University of California for use in the cotton fields of the San Joaquin valley. The system essentially seeks to disturb as little as possible the natural ecology of the field by manipulating natural biological controls for pests. Oddly enough, it seems also to be the most economic method of control, according to R. van den Bosch, of U.C., Berkeley, and his colleagues.

Since World War II, farmers in the valley had sought to control the two major pests, *Lygus*, a mirid, and *Heliothis zea*, a bollworm, by doses of the organochlorides. These proved to have an undesirable tendency to migrate, to persist, and to accumulate in the fatty tissues of warm-blooded animals. Their replacement with the organophosphates, however, was no great improvement. The organophosphates have none of these disadvantages, but neither do they last long enough after application to be as effective. Furthermore, heavy applications of either seemed to engender attacks upon the cotton by lepidopter pests and to damage the crop itself.

Integrated control is an alternative which combines cultural, biological, and chemical techniques. In 1969, when some of its parts were first tried, they proved more effective, less damaging, and less expensive than chemical means alone.

The first problem the entomologists faced was to determine what pests, and when, and how, were damaging cotton crops. This had never been clearly established. Threshold numbers of pests per plant or per net sweep at which economic loss occurred had been defined for *Lygus* and *Heliothis zea* but were found to be inaccurate. Chemicals were applied for others according to the whim of the grower, the persuasion of the salesman, or the presence of pests. A revised threshold for *Lygus* was defined, and this was perhaps the turning point of the program. It was found that the criterion used, ten bugs per fifty sweeps, was valid only if sustained over two tests four or five days apart, and then only from June 1 to July 20, when the commonly planted variety of cotton, Acala S.J. 1, is in the heavy squaring (flower budding) stage. After this period, fairly large numbers of bugs can be tolerated. It was found that *Heliothis zea* and other lepidopterous insects peaked one to two weeks after the heaviest moth flights, which in turn peaked at the dark of the moon and primarily during late July and early August. The two patterns fitted neatly together, and the entomologists advised growers to avoid chemical treatments for *Lygus* during this period, leaving to it the job of controlling the lepidopterous insects.

Growers who used this schedule in applying chemical controls during 1969 reported a low level of lepidopterous infestation. Further, it was found that these pests frequently feed on parts of the plant not harvested, so they might, at low levels, not be injurious.

Alfalfa, since *Lygus* prefers it to cotton, also provides a natural control. Strips of alfalfa 16 ft. to 32 ft. wide effectively protect 300 to 400 ft. of cotton, and the interplanting is easily accomplished. It has been used in some commercial fields and should be used more widely in the future. Microbial enemies of cotton pests may also prove successful as agents of natural control.

"A Few Will Make It"

Emotional factors—rather than a cold, hard-headed analysis of the problems and prospects—are usually behind the efforts of a black entrepreneur to buy or develop a ghetto supermarket. And so the prognosis is not very good.

"A dispassionate appraisal of the prospects for black owners of supermarkets in American ghettos can lead to only one conclusion," says Gordon F. Bloom, Senior Lecturer in the Sloan School of Management at M.I.T.: "A few will make it; most will fail."

Why make the effort? Because the supermarket has become the universal symbol of American affluence, it is the symbol of big business in the ghetto, and there is typically a critical shortage of good retail stores to

serve the needs of ghetto residents.

But the hazards are large, says Dr. Bloom. "The fact is that the record of black-owned supermarkets to date has been one of losses, sales below expectations, and—in a few cases—scandalous mismanagement."

The causes of failure are many. Supermarkets present a critical management problem: profits are a very low proportion of sales—perhaps only a little above 1 per cent; volume is high; mistakes can be very costly. The supermarket customer is critical—a sharp shopper who does not tolerate empty shelves or noncompetitive prices. There is no protection for the entrepreneur—no way for him to contract with his customers for their business for even a week, much less a year.

"Even the most experienced company cannot go into a new location, put its best manager in charge of the unit, and be certain that the new store will make money," says Dr. Bloom.

Another problem for the black supermarket manager: many of his customers don't need him as much as they think they do. "The typical ghetto customer has a low income and a continuing shortage of cash," says Dr. Bloom. "Shopping habits and consumer needs are in many ways better served (except with respect to price) by the small grocery store which gives credit."

Blacks also must face their image. Even a black customer, says Dr. Bloom, holds "a deep skepticism" for the business capability of a black manager. And there are relatively few blacks qualified for the job. "Indeed, in the next few years," says Dr. Bloom, "it appears that there will be more white-owned markets in ghettos for sale than there are black managers capable of operating them."

The solutions: find means to train blacks as managers; encourage food wholesalers to give special help to their black customers; provide government subsidy "to offset the cost differential of doing business in the ghetto;" and encourage consultant organizations to put together men, locations, and capital to operate supermarkets in ghetto areas.

"If a well-conceived, comprehensive program can be developed—backed up by men and money—the black-

owned supermarket can become a visible symbol of the opportunities that await black enterprise," says Dr. Bloom. If not, "the darkened supermarket will be a grim reminder of the failure of our society to face the problems of ghetto living."

An Accelerator's Work Force

When the National Accelerator Laboratory was established in Batavia, Ill., its staff—supporting a protest against Illinois' refusal of an open housing statute—promulgated what they called the N.A.L. policy statement on human rights, which contained the bold assertion: "In any conflict between technical expediency and human rights we shall stand firmly on the side of human rights."

In the three years since then, Edwin L. Goldwasser, N.A.L. Executive Director, told the American Physical Society in Chicago this winter, the Laboratory has had a remarkable—indeed, perhaps unique—record of success in stimulating the participation of minority groups.

To begin with, N.A.L. hired Kennard Williams, head of the local N.A.A.C.P. branch, as Chief of an Equal Employment Office. Mr. Williams in turn persuaded the head of Local 150 of the International Union of Operating Engineers to train 100 blacks from the Chicago ghetto to operate heavy earthmoving equipment; 86 completed the course and 72 of them are still working as operating engineers—many of them at N.A.L.

Next, N.A.L. began to send blacks to a technician training course at the Oak Ridge National Laboratory. Of the first 24 sent to the 30-week course, 22 are working at N.A.L. now; in all, one-third of the Laboratory's non-professional staff is black.

Finally, as subcontracts for construction and equipment have been written, the Laboratory has made a special effort to find minority industries that can fulfill its needs. At this writing about 40 per cent of N.A.L.'s contracts below \$10,000 for work at the site have gone to black contractors, and more substantial contracts are in the works.

N.A.L.'s construction—eventually a \$250 million job—is on schedule, and Dr. Goldwasser told the A.P.S. that this is so “more ‘because of’ than ‘in spite of’ these actions. What we believe we are showing at N.A.L.,” he said, “is that it is possible to pursue our scientific goals in such a way as to contribute to the solution of some of society's current problems.”—*Peter Gwynne*

Infrared Astronomy's “New Realm”

Ten years ago not a single source of infrared radiation was known outside our own solar system. Now a large number are known and more are being found—all prodigiously powerful—at an increasing rate. Indeed, said Frank J. Low, of the Lunar and Planetary Laboratory of the University of Arizona, at the 1969 meeting of the American Association for the Advancement of Science in Boston this winter, “when an infrared astronomer today goes to a telescope equipped with modern, sensitive infrared equipment, it is a rarity if he fails to discover some new object or new phenomenon.” The results, said Professor Low, may contribute to “uncovering a new realm of physics.”

Professor Low divides the bright infrared sources known today into two classes: infrared stars and nebulae which are relatively near to us, neighbors of our solar system; and those at great distances which are—with only one exception—outside our own galaxy. The near infrared sources seem in every case to be stellar systems in the early stages of formation, governed by well-established principles of physics and astronomy. But the phenomena responsible for the distant sources, said Professor Low, “are extremely difficult—if not impossible—to understand in terms of existing physical theory.”

The “distant-type” infrared source in our own galaxy—a source about one light-year in radius—radiates 10^8 times as much power as the sun, but it is the weakest galactic source known. Four galaxies show infrared luminosities of 2×10^{46} erg/sec., 50 times the total output of our galaxy, which contains 10^{11} stars like our sun. The origin of this vast energy is only the first of two difficult questions, said Professor Low; the second, and even more difficult, is to conceive a mechanism which radiates energy in this amount almost exclusively in the far-infrared.

To answer these questions, Professor Low has postulated the *irtron*, a solar phenomenon which represents the continuous creation of matter in galactic nuclei. Matter and antimatter are forming continuously in the irtron system, and the process yields infrared radiation—but in amounts considerably less than the total accumulating mass. The irtrons thus represent accumulating matter.

If this postulation satisfies the needs of cosmologists whose instincts are to reject the “big bang” concept of the universe, it raises larger issues for Professor Low.

“If we are witnessing continuous creation,” he told the A.A.A.S., “then laboratory control over the creation of matter and antimatter may not be impossible, as present theory predicts; and the practical applications would, in effect, be without limit.”

CO at Sea

When F. L. Ludwig and his associates from Stanford Research Institute took a sensitive carbon monoxide detector on board a freighter for a round trip between Norfolk, Va., and Bremerhaven, Germany, they found marked variations in atmospheric CO at many stages of the voyage. On the outbound trip there was one surge in the CO measurements after five days out: from negligible to 2.5 p.p.m. and thereafter a gradual decline through 0.8 to 0.4 p.p.m. On the return trip there was a series of ups and downs.

Analysis revealed that the CO concentration correlated closely with atmospheric changes, the highest CO concentrations corresponding with periods of subsidence in the lower levels of the atmosphere. On the eastbound voyage, traveling with the North Atlantic weather patterns, the scientists passed through only one weather front associated with subsiding air; on the westbound voyage they crossed a succession of east-moving weather fronts.

The CO they measured was not simply the product of America's industrialized northeast, the S.R.I. group reported to the spring meeting of the American Chemical Society in Houston. It was from the ocean itself, confirming other measurements of dissolved gases in sea water showing “a significant source of CO in the ocean,” said Dr. Ludwig. His theory is that subsiding air held the CO near the surface, where sensitive instruments could detect it.

Dr. Ludwig agrees that “the pollution sources of North America contribute to the CO burden in the air over the North Atlantic.” But he told the A.C.S., “the trajectories and the meteorological data support the premise that the atmospheric CO levels in the North Atlantic are augmented by the natural ocean source.”



Connecticut Scientific Center Ends the war...

A costly war that's been in existence in industry since its conception . . .
A war between engineering, tooling and production — . . . casualties . . . unexpected rejects — time lost . . . dollars lost and wasted. All this over dimensioning and tolerancing — combining their forces to elude the corporation.

CSC has developed a computer oriented design system — **SIMCO** — that resolves this war. **SIMCO** allows **CSC** to assemble your product in total or in modules in an exact three dimensional model — showing you all the effects of each and every pertinent dimension on the functional requirements. A complete and comprehensive evaluation of your product eliminates the three-way conflict — reduces wasted time in searching for a cause as elusive as combinations of in tolerance parts that produce out of spec end products.

This proven system (case studies on request) is ideal in two areas — (a) when your product is in its early design stages and prior to costly tooling or (b) when production is not what it should be.

SIMCO itself decides critical and non-critical dimensions. It decides what combinations cannot be assembled properly — if at all. It tells you how dimensional changes effect motion (if it is a part of the products performance). It tells you how the critical dimensions cause unsolicited headaches. It allows you to finalize decisions for realistic dimensioning — No more War . . .

Peace — Brother.



**connecticut
scientific
center**

72 Whitney Ave. New Haven, Conn.

The Realism of Under-water Psychology

"Contemporary research psychologists are like alchemists who have set up shop in a gold mine. While studiously ignoring the dust and nuggets of behavior lying all about, they proliferate vain attempts to transmute the base materials of artificial reactions and verbal reports into the gold of theories of behavior."

Thus began a paper by Roland Radloff of the Naval Medical Research Institute, Bethesda, Md., at the annual meeting of the American Association for the Advancement of Science. He was describing the research that his team did during **TEKTITE I**, in which four ocean scientists of the Department of the Interior lived for two months on the sea floor off the coast of St. John, one of the Virgin Islands. While these scientists studied spiny lobsters, reef fishes, and ocean floor geology, Dr. Radloff's psychologists studied them.

They observed the **TEKTITE** crew by television and heard their conversation. Systematically, and as objectively as possible, they noted where the men were, what they were doing, and in what groups. They collected this data 17½ hours a day for the entire two months. Dr. Radloff said that his work, here and on the earlier **SEALAB II**, has been hailed as "a new direction" and damned as "blind empiricism."

At present, Dr. Radloff said, the great majority of social science data is collected by interview and questionnaire—which record words, not facts of behavior. Studies of behavior in "exotic" environments use either simulations of these environments, on-site psychological tests which have to be performed in addition to the subjects' real work, or—most frequently—verbal questioning. Simulations, said Dr. Radloff, "lack two important features of real life environments. They do not contain life-and-death perils; nor do they provide the gratifications or frustrations associated with the fulfillment of or failure to realize lifelong ambitions"—which are rather important facets of human life. If, on the other hand, the life of the pioneer is studied by supplementing it with psychological tests, the test results are likely to give a distorted picture: subjects may neglect the tests, or "rise to the occasion" and perform them too well, or may keep them going only until a real crisis occurs—just the most psychologically interesting time.

In the past, one difficulty of studying the real world has been that it provides *too much* data. But modern electronic recording and processing equipment now offers some hope of making sense of the myriad details in which human nature reveals itself. "Other branches of science have been firmly grounded in systematically collected real-world data," said Dr. Radloff. The peculiar discrepancy in this respect between psychology and other sciences may be "due in part to the inability of ants, atoms, aardvarks and auroras to speak." He drew attention to some current observational work on child psychology, as suggesting "a still small but at least detectable shift in the Zeitgeist."



You'd smile, too, if you'd bought a few acres of Caribbean shorefront—and Blue Chip life insurance—back in 1949.

You can't build financial success out of sand castles. You need foresight. You need judgement. And you need facts. The fact about Connecticut Mutual life insurance is this: we have consistently been a leader in low cost for our policyholders, as proved again in the latest 20-year industry-wide cost study, 1949-1969. Yet, surprisingly, nobody builds better quality into their policies. If you'd like more details see one of our Blue Chip representatives. He'll accommodate you. Gladly.

...and this year: new policies, new rates, new low cost!

Connecticut Mutual Life
the Blue Chip company

YOUR FELLOW ALUMNI NOW WITH CML

Richard E. Boraks '59 Hartford

Ralph Mendel Grad. School New York

"I Have No Faith Whatever in S.A.L.T."

A second key issue scheduled for discussion March 3 and 4 at M.I.T.—related to the arms race—was the question of arms limitation and the Strategic Arms Limitations Talks under way among the nuclear powers in Helsinki and Vienna.

The opening statement of I. F. Stone, publisher of *I. F. Stone's Bi-Weekly*, summarized the dominant pessimism of the speakers on S.A.L.T.: "I have no faith whatever in S.A.L.T. or in any disarmament talks." The cynicism he expressed was confirmed by the insight into governmental decisions on arms limitations offered by M.I.T. Provost Jerome B. Wiesner, who was Science Adviser to President John F. Kennedy. Dr. Wiesner narrated how a numbers game, as he described it, dominated the international negotiations to limit nuclear weapons.

Negotiations deadlocked over the number of permissible inspections in each country. The President, he said, was caught between finding a number of inspections acceptable to both Khrushchev and the Senate Foreign Relations Committee, while Khrushchev was equally hard-pressed to find a number acceptable to both Kennedy and the Politburo. In the midst of this deadlock, Khrushchev proposed they both sign at least a partial test ban treaty—"and this was quickly agreed on." Thus, the 1963 Nuclear Test Ban Treaty came about.

However, some of the speakers offered grounds for hope. Provost Wiesner said that even in the "hawkish" climate of the Kennedy Administration, the grass-roots peace groups were a factor in bringing the U.S. to the negotiating table.

On the morning of March 4, George Kistiakowsky, Abbott and Lowell Professor of Chemistry at Harvard, who was Science Adviser to President Eisenhower, put the disarmament problem rather simply: "The public must realize that the arms race has a life of its own and that it is itself a cause of tensions, and that it must be reduced."

But, he said, standing in the way of the upcoming S.A.L.T. is the "worst kiss"

A. B. M.: A Deadly Real Soap Opera

This year's Congressional debate over the proposed expansion of the Anti-Ballistic Missile (A.B.M.) system will focus on politics—not engineering, said George W. Rathjens, Visiting Professor of Political Science at M.I.T., at the start of the second annual gathering of scientists and generalists on March 4 at M.I.T. And, as if by agreement with the importance of politics this year, all the March 3 and 4 speakers gave their topic, "The Arms Race," a distinctly political cast.

The A.B.M., a ground-to-air computer-regulated intercept system incorporated in a plan called Safeguard, was submitted to Congress by President Nixon last year; it raised voices in the scientific community claiming that technically it would not work and that it was strategically unnecessary. The plan squeaked by the Senate in a dramatic 51-to-50 vote. This year the vote will be on a proposed expansion of Safeguard.

Professor Rathjens told a March 3 press conference by the participants that in the year's interim, the Nixon Administration has "essentially conceded all the technical points against the A.B.M." And Representative Richard D. McCarthy of New York, speaking at the same press conference, predicted that this year the A.B.M. would fail in the Senate. Asked how the Nixon Administration could have shifted its technical pro-A.B.M. arguments so drastically in one year, Professor Rathjens said, "The President appears to be isolated from responsible, independent, technical opinion."

That evening, Jerome B. Wiesner, M.I.T. Provost and former Science Adviser to President Kennedy, explained why he thought the A.B.M. passed last year. "We opponents failed because of overkill. There were so many things wrong with the A.B.M. that we all made different arguments, and it got very confusing. And this," he added, "raises the important question of how to best put a complicated political-technical issue before the public and Congress."

Dr. Wiesner urged broader anti-A.B.M. support at the grass-roots level. "The disarmament challenge has been losing its appeal to the cause of environment, so we need to broaden the arms cause, open it to the silent majority, and even make it attractive to the President." He explained that the money now "wasted" on new weapons systems could, if spent elsewhere, make up the difference between a poor and a good national environment.

Dr. Wiesner offered some hope for the cause of disarmament by describing his perception of the changing mood of Congress since the early 1960's: "The very Congressmen who used to write letters to President Kennedy warning him what a dangerous person I was for believing in disarmament are now asking me to help them write speeches opposing the A.B.M."



Last year's March 4 conference was jointly sponsored by a student group, the Science Action Coordinating Committee, and a faculty group, the Union of Concerned Scientists. But this year's conference—sponsored only by U.C.S.—substituted in-depth, highly specific presentations on a single topic—the arms race—for the national publicity and controversy of last year. Highlights included the participation of Former Science Adviser to President Kennedy, Jerome B. Wiesner (far left), publisher and critic I. F. Stone (near left), and (below, left to right) Gen. E. L. Burns, former Sen. Joseph Clark, George W. Rathjens, U.C.S. moderator Lee Grodzins, and Congressman Richard D. McCarthy of New York.

He also offered hope—by contrast with other speakers on March 4—by quoting Edward Teller's testimony at the Congressional A.B.M. hearings last year; Dr. Teller maintained that it was still impossible for either side to "wipe out" the others' retaliatory land-, sea-, and air-based forces with a pre-emptive first strike. "Once you realize this," Dr. Wiesner said, "you have fantastic flexibility in the kinds of arms control agreements you can negotiate." The next day, Marvin L. Goldberger, Higgins Professor of Physics at Princeton and formerly a member of the President's Science Advisory Committee, delivered a carefully developed argument against A.B.M. which revolved around the "spherical senselessness" of the proponents' arguments: "It is interesting to read the testimony of the supporters of deployment; none ever talks about the actual Safeguard system."

The argument that U.S. arms buildups will increase the chances of negotiating an international arms control agreement "from a position of strength are self-defeating," he said. "This is the same argument we are apparently using with respect to the proposed appropriation for M.I.R.V. This is the other half of the view that the Russians are 20 feet tall and they have a ten-foot yellow streak down their backs. . . . Isn't this a mad charade? . . . One sometimes gets the feeling that one is watching an unfortunately deadly serious soap opera with a completely ridiculous plot. One can only hope that it will be resolved in some future episode by real statesmen talking to each other."

In support of this view, as well as echoing the feeling of many who spoke on A.B.M. on March 3 and 4, Professor Goldberger quoted former Secretary of Defense Robert S. McNamara: "What the world requires . . . is not a new race towards armament. What the world requires . . . is a new race toward reasonableness. We had better all run that race."



strategy. A military planner must of necessity draw up among his scenarios one which assumes the worst possible combination of events. "However, for the last few years, Presidents have been accepting the 'worst-kiss' analysis as the *only* one," he said. "Unless there is a *détente* between the U.S. and the Russians, the great battles of our time will be decided not in Helsinki or Vienna but between the generals and their leaders in Washington and Moscow."

Yet there is also the likelihood that nuclear weapons *will* spread to Israel, Japan, India, and West Germany, said General E. L. Burns, retired from the Canadian army. As the Canadian representative to the 18-nation disarmament conference in Geneva, General Burns described with authority the feelings of the non-nuclear world towards S.A.L.T. Article Six of the Test Ban Treaty provides that the agreement is effective only if the nuclear powers engage in "good faith" negotiations to limit arms. Yet, for the rest of the world, "how are we going to tell if the Helsinki and Vienna talks are in 'good faith' or not? We can only judge them by their fruits."

Another question is how long near-nuclear powers will wait for such an agreement; if they conclude that S.A.L.T. is not in good faith, they can go ahead and develop their own nuclear weapons in the near future. General Burns detailed the political pressures in Israel, India, Japan, and West Germany favoring development of nuclear weapons.

Wrapping up, I. F. Stone said, "For over a century man has struggled against armaments without avail." In nineteenth century Britain, he said, national security scares blossomed every time the Admiralty appropriations came up for approval. Even two archenemies of the period, William Gladstone and Benjamin Disraeli issued a joint statement favoring arms control. Later, two key politicians, Randolph Churchill and Gladstone himself, resigned over the issue. Finally, the great Duke of Wellington, at the end of his lifetime, warned that the French steamboat capability enabled France to throw a bridge of boats across the Channel and invade Britain. "All this makes us look slightly *déjà vu*," Mr. Stone said.



At a press conference for speakers at the second annual March 4 conference at M.I.T., Harvard biologist Matthew Meselson outlined the President's policy alternatives on chemical and biological weapons (see story, right). He also warned scientists that, if research and development on these weapons continues, it could pervert the future directions of biology and chemistry—from understanding and saving of life to destroying it. (Photo: Harold Federow)

The Political Future of the Geneva Protocol

At the March 4 conference on "The Arms Race" at M.I.T., Representative Richard D. McCarthy of New York, a leading opponent of chemical and biological warfare (C.B.W.), announced that if he were in the U.S. Senate he would vote *not* to ratify the 1925 Geneva Gas Protocol—the 84-nation agreement banning this very kind of warfare.

Why? His stand illustrates the fact that approval of the Protocol—and, indeed, the whole C.B.W. issue (see *Technology Review* for October/November, 1969 pp. 103-104)—has reached a crucial and complicated impasse. Here is how one expert, Matthew Meselson, Professor of Biology at Harvard University, who also spoke at the March 4 conference, views the issue. His conclusions: President Nixon has very few alternatives in coming months:

The U.S. has used certain so-called harassing gases, herbicides and defoliants in Vietnam for many years. When President Nixon in November announced that the U.S. would stop producing all biological weapons (he later included the nonliving mainstay of the U.S. biological weapons arsenal, toxins, under that ban), he made no mention of the so-called harassing gases or defoliants. But he said he would send the Protocol to the Senate for ratification.

Meanwhile, one month later, 80 nations voted at the United Nations that they interpreted the Protocol to cover the "harassing" gases (notably CS) under its ban. The United States joined only Australia and Portugal in opposing this interpretation. While he applauds President Nixon's decision thus far, Professor Meselson feels the President's choices are these:

1. He can send the Protocol to the Senate for approval, with a formal reservation that the U.S. does not accept a contractual relationship with the other parties regarding these chemicals and herbicides. But this risks the Protocol's chances of passage. Some Senators will oppose the notion that the U.S. would be, in effect, rejecting part of a bona fide international treaty. Others, opposed to the U.S. setting a precedent by continuing any chemical warfare, would oppose the reservation.
2. The President could send the Protocol to the Senate for approval with a statement of interpretation that we don't think it covers harassing gases and herbicides. Such a course walks a tightrope between those who are opposed to the U.S. using chemical weapons and those who wish to guarantee our continued use option to them, because passage of the Protocol in this form is almost inevitably open to challenge by the United Nations and the world court.
3. The President could wait until the issues surrounding the Protocol can be divorced from the controversy and acrimony that surrounds the Vietnam War. This means either phasing out use of these weapons in Vietnam now or waiting until the war subsides to the point that such weapons are withdrawn as a matter of course.

At the March 4 conference, Congressman McCarthy was pessimistic about the Protocol's future: "In 1925 the U.S. failed to ratify the Protocol despite the urging of the rest of the world. Nineteen-seventy may see a repeat of 1925."

Wood Would

Robert C. Wood, who already wears two big hats as Director of the Harvard-M.I.T. Joint Center for Urban Studies and Chairman of the Department of Political Science at M.I.T., has now donned a third: Chairman of the Board of the five-man Board of Directors of the Massachusetts Bay Transportation Authority. It was possible, when this was announced, to react with disbelief: what was this expert and former Undersecretary of the Department of Housing and Urban Development doing with something so ordinary as getting Boston's trains to run on time?

Recently, he told *Technology Review* why he feels the next three or four years will see "greater priority for public transportation on the national agenda." Government is beginning to feel "a disenchantment with highways *qua* highways and with single-modal transportation systems," he says. A growing concern with environment will become "a unifying theme, just as the issue of the ghetto was something of a disunifying theme." Finally, there is new sensitivity to the fact that mass transit can resolve regional problems of "dispersal of population, access, sprawl, and fair housing." Thus, says Professor Wood, the time is ripe for a major shift in policy. Despite its all-too-well announced weaknesses, Professor Wood says the M.B.T.A. has going for it "a set of factors . . . which make it potentially as good or better than any public transit agency in the country." He believes that there is "much more professionalism" there than is generally recognized. Finally, he sees it as an embryonic form of regional government; "if we can sensitize it, and civilize it a bit, the M.B.T.A. could be the forerunner of some kind of regional development."

But problems abound. One is "how to take an organization which has been told for 30 years it is bad and increase its goal activities." Another is that the M.B.T.A. is only just beginning to benefit from the costly acquisition of a regional bus company, the Eastern Massachusetts Street Railway, two years ago. The intervening two years have built up some backlog of deficit and ill will. Third is the financial problem, which may start to straighten out when the number of riders increases as a result of completing the system (22 miles—north to Reading and south to Braintree). Fourth is that of image: here, he thinks that improvements in "a lot of reasonably little things" such as reliability and service will help put on a more positive face. Finally, there is the labor situation: M.B.T.A. employees belong to 27 different bargaining units.

Although none of his three predecessors served their full five-year terms, Professor Wood is optimistic that the broad forces at work now, including the mood of the federal government in rapid transportation (read dollars), will finally bring the M.B.T.A. into its own. Will the new Chairman be able to help? Given his optimism, it is possible that Wood will.



The M.B.T.A.

The Massachusetts Bay Transportation Authority, which recently acquired a new Chairman of its Board of Directors, Robert C. Wood (see left), has its own set of problems—both real and alleged.

◇ Geographical. Boston taxpayers pay for 38.5 per cent of the total new services of the system, although residents of 78 other cities and towns use it as well. Since the tax base of Boston has, if anything, shrunk in the last 20 years, funds for updating and expansion have been difficult to raise locally. Even suburban commuters who can ride back and forth in cars rely on the automated transport to limit the number of cars on the highways: yet they pay a disproportionately low share of the cost.

◇ Financial. Since the Second World War, Boston's system has run in the red; the 1969 net cost of service has been estimated at \$57 million, or half of the \$126 million operating expenses. Some predict a 20 per cent rise in the deficit next year.

◇ Competition with highways for state funds. In 1946 the system carried 433 million people; but its load has dropped with the expansion of the metropolitan highways since. In 1969, rapid transit carried only 194 million people.

◇ Politics. Newspapers announcing Professor Wood's appointment cited his "non-partisanship" as an asset. The Chairman, who virtually runs the M.B.T.A., is appointed by the Governor, but past chairmen have often found themselves locked in political battles with other elected officials, mostly the Mayor of Boston. Of the past three Chairmen, none has served his full five-year term.

◇ Patronage. Critics of the Authority charge that the agency is the victim of ethnic discrimination and political patronage. This situation has contributed to the organization's apparent poor morale.

◇ Labor. Over the last 30 years, declining funds have meant that fewer workers must maintain the same stations and tracks. Meanwhile, the number of bargaining units has increased, each of which negotiates new, separate contracts with the agency.

After being sworn in as Chairman of the Boston transportation authority, the M.B.T.A., M.I.T.'s political science head Robert C. Wood (right) went on a ride over Boston's subways with the man who appointed him, Governor Francis W. Sargent (center). One rider who saw the officials entering the car muttered, a reporter said later, "He's probably one of the high-paid ones, the overpaid kind." For running Boston's problem-ridden transit system, Professor Wood receives approximately \$10,000 per year.

Dr. Salvador Luria receives from King Gustavus of Sweden the 1969 Nobel Prize in Medicine, shared with Dr. Max Delbruck and Dr. Albert Hershey, for work with the "replication mechanisms and genetic structures of viruses."



A Nobel Laureate's Ode to Scandinavia

A limousine at his disposal (a standard courtesy to prize winners), his first chance to practice medicine in 30 years (an unfortunate guest fell through a glass door and cut a facial artery), and an appreciation of Sweden's politics and culture were a few of the pleasures attendant on Dr. Salvador Luria's visit to Stockholm to receive his Nobel Prize (see *Technology Review* for December, 1969, pp. 60-61; he is Sedgwick Professor of Biology at M.I.T.).

Perhaps Dr. Luria's strongest impression after the week in Stockholm—and what he seems to enjoy discussing most—is that of an informed, enlightened society functioning efficiently and flexibly. "There is a great mutual trust between the public, even the students, and the royalty and Prime Minister," he said. "It is all quite relaxed. The Prime Minister and other public officials have a candor and eagerness in expressing what they are trying to do, towards both their own public and the rest of the world. They have candor even about their shortcomings.

"The social system itself is highly flexible," he continued. "This is possible in part because Sweden is a small country, and a rich one. They have enough space for their 8 million people. And they're Swedes."

Dr. Luria was particularly impressed with their design and use of public facilities. "In Sweden these facilities are used by all people, not just by the middle and upper classes who are the only ones aware of them in the United States. Day care centers for working mothers have been well established. And the first priority for places goes to unwed mothers, then divorced ones, and then to the most needy by income," he said. "The palace is open to visitors, rather like a museum. One room, which houses modern art, is a place where parents can leave their children while they see the palace. It has easels and old theatrical costumes for children to play with." There are, of course, very high taxes to support these services, and the taxes are stiffly graduated, "but everyone pays taxes, and the people don't seem to complain. They know what the money pays for."

Visits to the Karolinska Institute and a number of receptions provided good opportunities to talk with Swedish scientists, some of them old friends. This revealed Swedish society to have effects upon its scientists and students

different than ours. Both groups seem less disposed to social protest. Dr. Luria feels that this is because the government and social system are more flexible in their responses to needs for change. There are a limited number of places for medical students to serve apprenticeships, for example, so they may begin to practice general medicine under supervision after two years of medical school while awaiting a place in their specialty.

"And Swedish scientists are not so involved in politics as we are," he said, "because their government is not involved in actions which cause them moral conflicts."

Their attitude towards the United States? "The people with whom I talked were quite disturbed by our attitude towards Sweden—they were, of course, very civilized in their expressions—but upset nonetheless that we have sent them no ambassador for several years. Or the refusal of New York dock workers to unload Swedish ships—they feel this is preposterous." Does he think the United States, given its size, might someday function as well? "We've got to."

By the Skin of Our Teeth

"If you don't want to stick with medicine all your life and you want to get into biology, the thing to do is study physics."

That is the advice of Dr. Salvador E. Luria, M.I.T. Professor of Biology and recent recipient of the 1969 Nobel Prize in Medicine (see *Technology Review for December, 1969, pp. 60-61.*), addressing a winter meeting of the M.I.T. Alumni Advisory Council. Dr. Luria cited this development in the history of biophysics since the 1940's as *the* major change in the study of biology in the last three decades: it was natural, he said, that if you wanted to understand what a gene was you studied a virus. Why? Because the virus was the smallest unit then known in an actual rather than a theoretical way. The logical viruses to choose for study were those which grew inside bacteria, he said, because they were "cheap and easy to work with."

"With the construction of the DNA molecule, the gene became as real as the atom with its well-defined structure. We know now what genes are and their functions. The hard questions remaining are how to achieve their regulation; how each kind of material, such as muscle, learns its gene-producing lessons," said Dr. Luria.

As yet, knowledge gained has yielded no practical application to genetic engineering—the application of knowledge to altering not only the function of an organism but also its heredity. Dr. Luria thinks, however, that it will be possible to do so in 20 or 30 years. "This area of investigation is hot on the curiosity scale right now. Given a set of genes that an organ has and given a set of controls, it should be possible to achieve a predetermined product. But the cells of each organ have a structure too, and that structure is important and necessary for the product to work efficiently. We must learn to understand where a product should go, how it goes to the right place and how it is assembled when needed."

Genetic engineering could make possible the production of identical twins by the thousands. "With cows," he pointed out, "there is no problem; economics can dictate decisions. The difficulty is with humans. The knottiest question on the use of genetic engineering is the choice of adaptive priorities. We do not yet have the wisdom to answer a question like this.

"The technology may become available before we are able to cope with it. The history of man is the history of powers gained before the balance to use them wisely, and the human race is always ready to make some blundering applications as well as some fast ones. The idea is to find which applications are desirable; this is in the future. But by the time genetic engineering

Pusey to Retire

Shortly after publishing his 1969 Annual Report (see right), Harvard University President Nathan M. Pusey submitted a letter announcing he will retire in June, 1971, two years before he reaches the mandatory retirement age of 65.

The *Boston Globe* said the announcement met with "mild surprise." On the one hand, there was little cause for surprise, because in recent years on turmoil-laden campuses, many university presidents have retired early or resigned. However, on the other hand, Mr. Pusey has been known for his stout defense of university traditions—particularly for his defense of academic freedom in the 1950's when Harvard was attacked by Sen. Joseph McCarthy. President Pusey's major achievements in office include making possible Harvard's expansion program of the last decade and raising the nation's oldest university's endowment from \$308 million to more than \$1 billion since he took office in 1953.

The following is the main text of his letter to the Harvard Corporation:

"The new period which is now beginning for higher education poses a formidable array of difficult problems for Harvard (though this in itself is nothing new). I have learned in 25 years as a college president—16 of them here—that a considerable interval (not uncommonly something like ten years) is required in the administration of a university between the undertaking of a major project and its achievement. In the light of these considerations it seems to me, as I indicated to you last year, that the next change in presidents of Harvard should occur fairly soon, preferably near the beginning of the fresh chapter rather than three years from now when I shall have reached the mandatory retirement age. If this can be arranged, my successor will have an opportunity to help design and order the new developments of the era ahead as well as effect their fulfillment.

"I very much regret adding another major task at this juncture to the many with which you have recently been and are still confronted. But I do not believe the University's interest can be served now by what could at best be a brief postponement. It has always been Harvard's strength—rooted as she is in tradition—that she has never had any inclination to mark time. Her characteristic manner is to be continually making fresh starts. Those great classes of graduates—largely of the 1920's and 1930's—which have made my administration possible have in considerable measure now discharged their responsibility—especially perhaps those of the twenties of which I am a part. In any case the time has come for a renewed effort which will enlist the energies of many younger Harvard men. My request therefore is that you proceed to this important task as quickly as you can."

is available, we will have had some experience with serious social engineering via the population control problem."

"How, believing as you do that man cannot handle what you are trying to discover, can you go ahead with your inquiry anyway?" asked an alumnus during the question period. "The answer," Dr. Luria said quietly, "is simple: If I don't somebody else will. What we need is not a moratorium on science but a moratorium on its application—technology. It's always a question of how you use your knowledge. 'Copping out' because it's too dangerous is nonsense. As is usual with humanity, we'll probably get by, by the skin of our teeth."

Harvard Reports on Crucial Changes

In his bitterly pessimistic annual report to Harvard University's Board of Overseers, Nathan M. Pusey calls this the crucial change for the American university: there is a feeling, he writes, that "it is not sufficient to pursue knowledge for itself, but that somehow knowledge must be put to work for moral, social, and political ends."

Change—too fast for the faculty, too slow for the students—is the common denominator. Today's students, says President Pusey, "are rightly skeptical of glib references to past history and insist that the University live up more closely to its best purposes and potential. . . . They are insisting only that neither they nor Harvard can ignore nor seek to escape social responsibility."

In their annual reports, two Deans of Harvard graduate schools write more directly of these issues. The goals of today's medical students, says Robert H. Ebert of the Faculty of Medicine, are changing: a majority now indicate "career goals in practice or community medicine, with a strong concern for the delivery of health care, rather than in science." He describes today's medical student as "more intellectually competent, more self-reliant, more idealistic than previous generations."

Issues pressed by Law School students, says Derek Bok in his first report as Dean, are no less relevant: a reduction of the curriculum from three to two years, more specialization, and more skills—statistics, cost-benefit analysis, uses of the computer, programming, budgeting, and systems analysis. But how can one guess the skills needed 20 years from now? asks Dean Bok.

President Pusey calls 1969 a "dismal" and "costly" year—measured in "hours wasted and opportunities missed, in the increase in internal political activity at the expense of learning and scholarship, in the erosion of confidence and trust and respect, in the promotion of distrust and hostility, the injury done friendship, and the defeat of reason and love."

The future hardly looks better. "Costs continue to rise. Income will surely be harder to come by. Competition for federal funds will become more intense at a time when science and universities are both declining in public favor. . . . Recent occurrences on our campuses have raised questions in the minds of perceptive potential private donors about the value and promise of our efforts," writes President Pusey.

But Mr. Pusey gives a heateening estimate of today's student: "The great majority care deeply and sensibly about Harvard and respect her achievement and her aims and tradition, and very much want to become part of them. . . . Like their contemporaries in many places, they are angered at the shabbiness and shortcomings which mar our national life, and feel deeply that in this perspective Harvard, and their being at Harvard, should somehow make a difference . . ."

So near to so many
attractions, and yet so
beautifully removed;
a hotel in the quiet
European tradition.



Planning
and
Financing
Services
to innovative
enterprise

matrix securities co.

53 State Street
Boston, Mass. 02109
(617) 227-5580

Complete
Professional
Service
In

**BUILDING
CONSTRUCTION
ALTERATIONS**

hhh

**h. h. hawkins
and sons company**

175 California St.
Newton, Mass. 02158
(617) 244-8111



**BUILDERS AND
CONTRACTORS**

240 SIDNEY STREET

● CAMBRIDGE, MASS. 02139

● 876-7505

Integral Solutions, Ladders, and Pentagons

Apparently this column is actually read by someone outside my immediate family. It was a pleasant surprise to see "Puzzle Corner" referred to in no less than Martin Gardner's "Mathematical Puzzles and Diversions" appearing in *Scientific American* for March. It is an honor to be mentioned in the most famous puzzle column written in America.

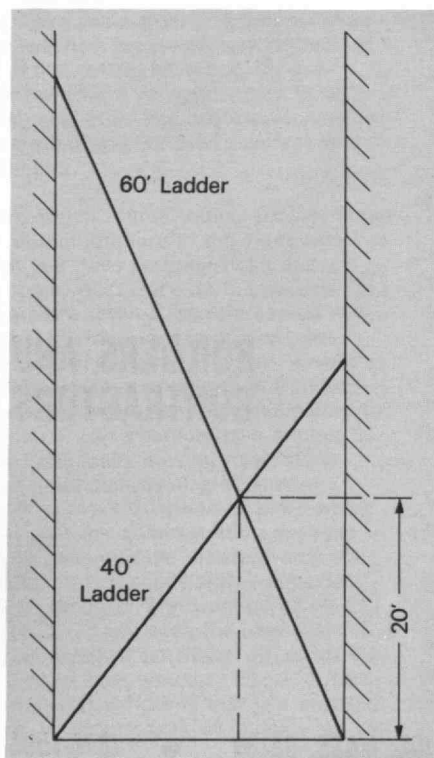
Does this entitle me to a free subscription to *Scientific American*, or must I continue to grub off my wealthy friends?

Problems

26 Frank Rubin wants you to show that there are infinitely many integral solutions to $x^3 + y^3 + z^3 + w^3 = 0$.

The following is from Norman L. Apollonio:

27 A 60-ft. ladder and a 40-ft. ladder intersect 20 ft. above street level. How wide is the street?



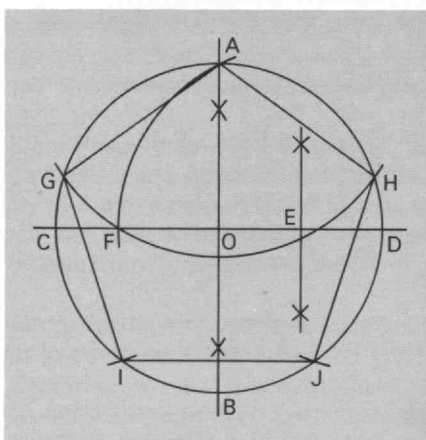
Here are two related problems in one from C. E. Hedrick; he calls them "two concealment ciphers which might be a challenge":

28a "Pediatric researchers find that apparent learned errors attenuate reliable actions, channelling unavoidable patterns at neural circuitry. Assuming aggressive or regressive patterns at an early age tends to reinforce the unreliability."

28b (somewhat harder) "In legal disputes, the most rational attempts to respond to accusations necessitate thorough research, high standards, astute observation, the psychologist's feeling for allusion, and all possible care to avoid countersuits."

29 William J. Wagner wants you to show that given three unequal circles whose centers are noncolinear, the points of intersection (A, B, and C) of the three pairs of common tangents are colinear.

The last problem is from Norman D. Megill, an M.I.T. sophomore:



30 The drawing shows the construction of a pentagon, using only a straight edge and a compass. The construction is as follows:

1. Draw a circle with center at O.
2. Draw line CD through the center of the circle.
3. Construct the perpendicular bisector to CD, line AB.
4. Construct the perpendicular bisector

to OD, dividing it into two equal parts, OE and ED.

5. Place the compass point on E and the lead on A, and draw arc AF.

6. Place the compass point on A and the lead on F, and draw arc GH.

7. Leaving the compass with this setting, place its point on G and locate I on the circle.

8. Leaving the compass with this setting, place its point on H and locate J on the circle.

9. Draw the pentagon using points I, G, A, H, and J.

The problem is to prove or disprove that the figure constructed is a regular pentagon.

If one analyzes the problem trigonometrically, it reduces to showing that

$$\sin 36^\circ = (\sqrt{10} - 2\sqrt{5})/4. \quad (1)$$

This I have not been able to prove or disprove. However, using 10-place tables, I find that

$$16 \sin^2 36^\circ = 5.527864045 \dots \text{ and}$$

$$10 - 2\sqrt{5} = 5.527864045 \dots$$

Can any reader prove or disprove the relationship (1)?

Speed Department

The only two speed problems are very similar and come from Frank Rubin. Critical shortage: send speed problems!

SD10 Arrange four toothpicks to make four isosceles right triangles.

SD11 Now try to get seven using five toothpicks.

Solutions

11 A living group calculated its collective grade point average for the all-campus competition. The average grade point was determined to be $3 \frac{1}{3}$. The members of the group were also competing for the Voo Doo Highest Average Reciprocal Grade Point Award. This grade point is formed by averaging the reciprocals of the individual grade points.

This living group was the last to enter the competition, and the highest average reciprocal grade point prior to their entry was 0.29. The group had to rush to enter before the competition deadline

and had time only to calculate their average grade point of 3 1/3. However, the judge looked at this number and declared the group to be the winner of the Voo Doo Award. How did he know?

The following is by James P. Friend:
The average grade point =

$$G = \frac{1}{n} \sum_{i=1}^n g_i$$

where g_i are the individual grade point scores and n is the number of individuals in the group. The average reciprocal grade point R is

$$R = \frac{1}{n} \sum_{i=1}^n \frac{1}{g_i} \text{ Now}$$

$$RG = \frac{1}{n^2} \left[\sum_{i=1}^n \sum_{j=1}^n \frac{g_i}{g_j} \right]$$

$$= \frac{1}{2n^2} \left[\sum_{p=1}^n \sum_{q=1}^n (g_p/g_q - g_q/g_p) \right].$$

Examine one term in the second double sum:

$$g_p/g_q + g_q/g_p = (g_p^2 + g_q^2)/g_p g_q$$

$$= [(g_p - g_q)^2 + 2g_p g_q]/g_p g_q$$

$$= [(g_p/g_q) - 1]/(g_p/g_q) + 2.$$

$$\text{Therefore } g_p/g_q + g_q/g_p > 2.$$

Since there are n^2 such quantities in the double sum,

$$RG > 1 \text{ (} RG = 1 \text{ for } g_1 = g_2 = g_3$$

$$= \dots = g_n).$$

The judge knew this relationship;

$$\text{for } G = 3 \frac{1}{3}, R > 3/10.$$

The following alternate solution deserves special merit for something, but its quality will be appreciated only by those familiar with *Voo Doo*, M.I.T.'s late lamented "humor" magazine; it comes from J. Shelton Reed, who was *Voo Doo*'s editor in 1963-64: "The judge knew the living group had won the *Voo Doo* reciprocal grade point award because he was a *Voo Doo* staffer and thus had powers beyond the ken of ordinary mortals ..."

Also solved by Peter Ross, John Pierce, Mark Yu (who calls himself "the homologized kid"), Gary N. Sherman, Arthur W. Anderson, Captain John Woolston, R. Robinson Rowe, James W. Dotson, and Frank Rubin.

12 On the following bridge hands

♠ A K 9 4 2	
♥ A 3	
♦ A 6 5	
♣ A 7 3	
♠ 6 3	♠ 10
♥ Q J 10 9 8 7 6 5 4	♥ —
♦ K	♦ Q J 10 9 8 4
♣ 2	♣ Q J 10 9 6 5
♠ Q J 8 7 5	
♥ K 2	
♦ 7 3 2	
♣ K 8 4	

the bidding was West, 4♥, North, double; East, pass; and South, 4♠. Lead is Q♥. Dummy's ace is put up and ruffed by East. Make any return.

The following is from Leon M. Kaatz:
The problem is to make 4♠ after the ♥Q is led, covered by the ace in the dummy and ruffed by East with the ♠10. On trick 1, declarer must throw away his ♥K. Whichever minor suit East returns, suppose clubs, is won by dummy's ace at trick 2.

Tricks 3 and 4: ♠Q and ♠J pull trump.

Trick 5: Cash ♦A (or ♣A if trick 2 was a diamond).

At this point the exact location of all the outstanding cards is known. Trick 1 revealed West to have started with nine hearts, and since he has come up with two spades, one diamond, and one club he must have exactly the ♥4 through ♥J left. This leaves East with eight minor suit cards at this point.

Trick 6: Lead out ♥3, forcing West to win.

Trick 7: On the forced heart return a diamond is thrown from North while South ruffs.

Tricks 8 to 10: North cashes three high trumps.

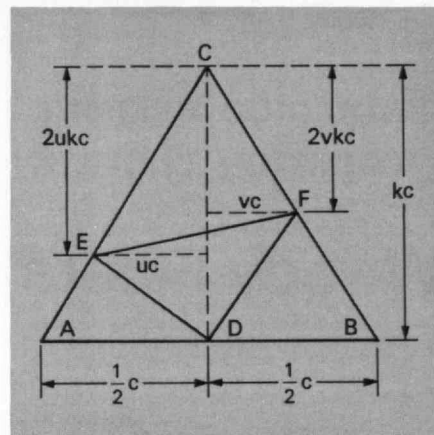
While the last trump is led out (trick 10), North has one diamond, two clubs, and the trump; East has four cards in the minor suits; South has two diamonds and two clubs headed by ♣K (♣A has been cashed); West has four hearts. If, on the lead of the ♠9, East goes down to one club, then South throws off a diamond.

Tricks 11 and 12 are now won by South's two high clubs to fulfill the contract. If East goes down to one diamond on the lead of ♠9, then South throws off his low club. A diamond is now led from the North hand, forcing East to win with his singleton. East must now lead a club which South will win with the ♣K. South now cashes the 13th diamond to fulfill his contract.

Also solved by a long list of bridge players: Smith D. Turner, Henry C. Howarth, Captain John Woolston, James W. Dotson, R. Robinson Rowe, Don Williams, Stan Horowitz, Eric Weitz, Paul M. Horvitz, Don Forman, F. W. Milliken, Edward S. Gershung, Bill McClary, E. C. Ingraham, William P. Bengen, C. C. Crystal, Robert H. Park, Edwin Burmeister, P. J. Sullivan, and William G. Kussmaul, Jr.

13 Find conditions on the ratio of the altitude to the base of isosceles triangle ABC such that the inscribed triangle DEF with maximum area (D is at the midpoint of AB) has FE parallel to AB.

The following is from R. Robinson Rowe: The figure published did not agree with the text, as it showed equal angles at E and F, which is not given (though it will follow).



My figure purposely shows these angles unequal and EF not parallel to AB. We are given that triangle ABC is isosceles, that D is at the midpoint of AB, that triangle DEF is so inscribed in ABC as to maximize its area. We are asked what ratio of altitude CD to base AB will make FE parallel to AB.

Let this ratio be k and express dimensions in terms of the base $AB = c$. Identify E and F by their distances uc and vc from CD. Let the area of $DEF = A$ and $ABC = A'$. Then $A = A' (u + v - 4uv) = \text{a maximum}$
 $dA/du = A' (1 - 4v) = 0$ and $v = 1/4$
 $dA/dv = A' (1 - 4u) = 0$ and $u = 1/4$
 Therefore $2ukc = 2vkc = 1/2 kc$ and EF is parallel to AB for any value of k . Also, $A = 1/4 A'$ for any value of k .

Also solved by Mark Yu, Frank Rubin, Captain John Woolston, and Jerry L. Robertson.

Better Late Than Never

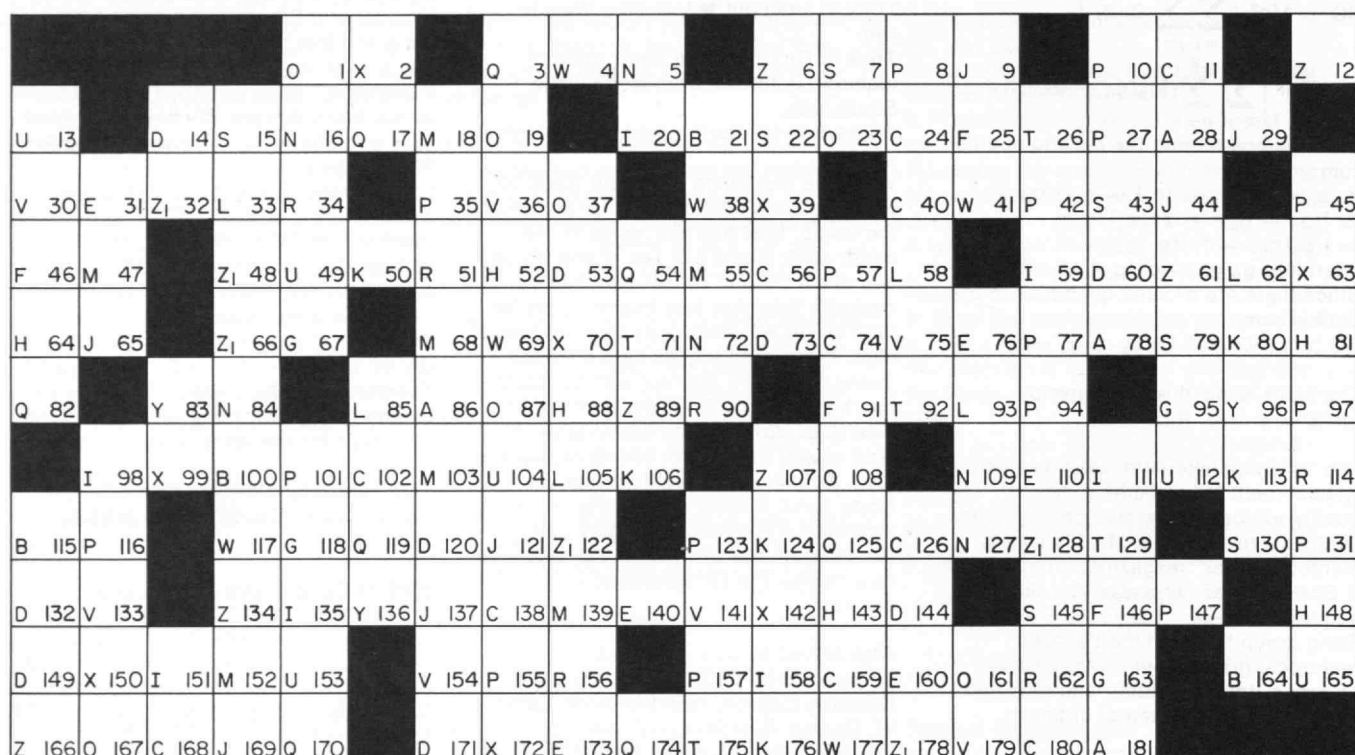
There are further replies on two problems published last year. On problem 29, Michael Beeler has some different results from those published in December, 1969 as shown below.

Frank Rubin points out that he did *not* solve problem 31, though we gave him credit for doing so in October/November.

Allan J. Gottlieb studied mathematics at M.I.T. with the Class of 1967 and is now a Teaching Assistant at Brandeis University. Send answers, problems, and comments to him at the Department of Mathematics, Brandeis University, Waltham, Mass. 02154.

n	1	2	3	4	5	6	7	8
2	32	34	23	1				
3	215	306	287	83	9			
4	2512	2918	2280	1068	210	12		
5	31062	32664	15764	7935	2190	365	20	
6	368718	339305	105506	57685	22245	4111	2430	
7	4217249	3283295	783760	436801	199956	36708	37002	5229

Woody Fibers and Warm Springs



Use the definitions at the right to help define the words to which they refer; then enter the appropriate letters in the diagram to complete a quotation from a scientific work. The first letters of the defined words give the author and title from which the quotation is taken. Black squares in the diagram indicate the ends of words; when there is no black square at the right end of the diagram, the word continues on the next line.

The correct solution to this Tech-Crostic will appear in the May issue of *Technology Review*.

David L. Holt is Assistant Professor of Metallurgy at M.I.T. He will welcome readers' comments; address him in care of *Technology Review*, Room E19-430, M.I.T., Cambridge, Mass., 02139.

A. Vessel.

86 28 78 181

B. Thread carried by the shuttle.

164 21 115 100

C. Streamline movement in a viscous fluid near solid boundaries (2 words).

24 138 74 56 180 159 102 11 40
168 126

D. To travel about or on a circuit.

73 144 149 53 60 171 14 132 120

E. Male relative.

76 140 173 31 110 160

F. To begin; to give promise.

91 25 46 146

G. Barbed spear or iron hook.

163 118 67 95

H. Showing the influence of accident rather than design.

52 88 143 64 81 148

Unique, individualized Vocational and Educational Career plan determines realistic goals for boys and girls in Grades 7-12. Accredited college-prep courses in English, 3 languages, science, math, history. Remedial Reading Classes limited to 5. Driver education. Broad cultural program. Swimming, golf, tennis, riding and other recreational opportunities in White Mountains. Inclusive fee covers everything. Scholarship aid available.

FRYEBURG ACADEMY
FRYEBURG MAINE 04037

Z₁. Freeholder.

R. F. Wright
Technology Review
MIT E19-430
Cambridge, Mass. 02139
(617) 864-6900 Ext. 4871

Four Views of Student Activists

Keep the School Running

To the Editor:

Alvin Gutttag, in his letter to the *Review* (February, 1970, p. 87), would like to have seen immediate action in ousting the students from the President's office—a good idea if in the doing the whole school didn't fall apart.

It seems to me that the easiest action to have taken would have been to call in the police and to have had them get on with restoring "order." But—what might have been the reaction of the other 8,000 students in such a case? It seems easier to deal with 40 or so students than with a much larger number.

The most important activity, overall, is to keep the school running on schedule. That was done.

A. W. Bigus
Brookline, Mass.

Troubling and Inconceivable

To the Editor:

Several classmates have written me and others have phoned from great distances to see if I could give them assurance that things at the Institute were under control, and I want to share my thoughts with them and others of your readers who find current affairs troubling and even inconceivable. The sit-ins, the bash-ins, the demands for ceasing military research are all so incomprehensible to the philosophy of our generation that the natural reaction is: "Why not call in the troops and clean them out?" Then we quickly reflect that the Communists do just that, and much more, but democracy doesn't work that way. The Communist student and non-student groups that masquerade under many different names and initials know this and take advantage of every opening allowed by a democracy. Many openings will have to be plugged before it becomes too difficult for the rabble rousers to be worth their while. Meanwhile, your concern and mine must be that the Institute's administration is handling events in the best possible manner within the available framework.

Being a little closer geographically to

M.I.T. than many readers I can only give them my personal reactions. When I first heard about President Johnson's office and Jim Killian's office being occupied, the militancy in me said, "Why didn't they call the cops and throw them out?" We have all seen the goosestepping, helmeted police on television cleaning out the rabble rousers at other institutions and we have seen the shambles—both physical and in morale—left behind. I think we can be proud of the "cool" with which M.I.T. withheld its wrath, served trespass notices and so caused the 30-odd demonstrators to leave voluntarily; legal charges were quickly brought against 29, eight of whom have no connection with the Institute. This small cancerous group (less than 0.5 per cent of the student body) can and will be dealt with in the courts, instead of the corridors, which was far from their intention.

During this serious incident, all activities went on normally which certainly has not been the case at many other schools. It undoubtedly would not have been the case at M.I.T. if the incident had not been handled with great skill. The Institute is still extremely vulnerable to the revolutionaries, but as time goes on new legal means certainly will be utilized to prevent disruption. Injunctions obtained last fall against threatened uprisings held the lid on then. Much has also been learned from poor handling of incidents on other campuses. These are trying times for Institute administrators but they are acting with the backing and guidance of staff, Corporation and alumni advisers, and most important, the students themselves—except for a few crackpots.

George Warren Smith
Pigeon Cove, Mass.

Mr. Smith is Secretary of the M.I.T. Class of 1926.—Ed.

Physics under Field Conditions

To the Editor:

Perhaps your readers will be interested in this exclusive interview with Howard W. Johnson, President of M.I.T., one hour after demonstrators, wearing ski masks and using a steel-pipe battering ram to break into his office the night before, had left the scene.

"Golly, this whole situation upsets me terribly. There are so many things I will have to do to straighten things out, I don't know where to begin.

"I'm just going to have to have a strong talk with the Head of the Mechanical Engineering Department. Imagine these kids not learning more about the strength of materials than they do. Look at my doors. It took three blows with that ram to break them down. If they were M.I.T. students, I'd certainly give them no more than a C minus for that job.

"And that battering ram. Their physics instructors are definitely going to hear from me about this. The demonstrators underestimated by several orders of magnitude the dynamic energy of the ram. Perhaps, to give them due credit, they underestimated the number of their friends who were supposed to join in and lend weight to their blows.

"The use of a battering ram to open a door really upsets me. I have sent out a call to all alumni to rush emergency funds for a complete updating of our textbooks. No wonder there is dissatisfaction in schools of technology these days when students are taught to use methods and devices that went out with the dark ages.

"But look at the point where they hit the doors. It's just 3 in. above where I calculate the point of impact should be to open the door with the least amount of effort. That's really quite good under these field conditions and I would recommend at least a B plus grade if these people are registered in any of our laboratory or experimental classes.

"This whole situation is so disappointing! You surely know how hard we have worked to make our Humanities Department the equal of our Departments of Science and Engineering. But these demonstrators, if they were students, seem to have violated many of the sociological and psychological principles of social organization and social change. I will just have to get over to those departments next week and have a serious talk with the deans. Here it is, the middle of January, and the students seem to be hung up on the theory of social conflict. It's just a

shame they haven't progressed past this point by now.

"But you know, I suppose, it's just a matter of poor communications all around. We all agree that the greatest advances in electronics and information systems cannot supplant human, face-to-face communications. Of course, it's been awfully cold here in Cambridge the last month or so, and I don't blame anyone for not wanting to open his mouth more than he has to. And, to be awfully honest with you, we have so many professors who have such definite New England accents that I don't wonder some of the students from other parts of the country have a hard time understanding them.

"I've been here over 15 years now and I still can't figure out what some of them are saying.

"Enough of this negative thinking, though. Let's lay plans for some positive action for the future. Why not come with me for a walk outdoors along the banks of the Charles River. The clean, refreshing, invigorating breezes from the river will surely clear our minds."

Donald E. Burke
St. Petersburg, Florida

A Clear and Present Danger

To the Editor:

In assessing the seriousness of student attacks upon orderly conduct within a university, I find that the administrations of most colleges (except, perhaps, Berkeley and Columbia) apparently proceed on the assumption that the disturbances are entirely the work of youthful exuberance, sometimes mixed with genuine grievances against restraints or gaps in the curriculum. It is my contention that this is a foolish and dangerous misunderstanding of a situation rapidly becoming irreversible. If we do not soon find a way to put an end to all campus anarchy, we shall lose American education to chaos.

However well insulated university managements may be, there must be some awareness that we are on the threshold of a nationwide revolution by which unruly elements of youth intend to destroy the American system in order to adopt the socialist-communist form of tyranny. The question at issue, I believe, is whether the college administrator can be induced to look the menace in the face, by informing himself of the well-established fact that there is, in virtually all cases of student attack, proven outside influence, planning and direction.

I will take as my chief example the trouble at M.I.T. reported in *Technology Review* for February (pp. 72A-72D). The action taken by the Institute—or rather the lack of action—suggests that no one in authority felt that this brouhaha was anything more than student insubordination—illegal, yes, but forgivable to all but a few ring-leaders—whereas the probable truth is that the M.I.T. seizure of the President's office, the second attack in

two months on university property, had been as thoroughly planned and as skillfully mounted as have been the continuing assaults upon the University of California at Berkeley and countless other student aggressions.

J. Edgar Hoover said (F.B.I. Law Enforcement Bulletin, February 1, 1967): "At the core of these campus disorders, and often below the surface, we find agitator personnel from organizations such as the communist W.E.B. DuBois Clubs of America and their comrades in the Students for a Democratic Society (S.D.S.), a so-called 'New Left' group; members of the Progressive Labor Party, a pro-Red Chinese group; and individuals associated with organizations under the control of the subversive Socialist Workers Party and similar groups."

I submit that there is no university in the world more coveted as a target for destruction by these forces than M.I.T. Already they have been felt in the shocking interruption of advanced guidance work at the Instrumentation Laboratory and the severance of C. Stark Draper from the directorship, an action reported to have been demanded and obtained by the S.D.S.

Hoover wrote his accusation three years ago. Today, the attack is far better organized and more deadly. One can number on the fingers of one hand the college administrations in America which have taken resolute action and have definitely prohibited any sort of out-of-line activity on campus. It is very difficult to understand, nay, to believe, the spineless inattention to the dangers of open revolution in America which characterizes nearly all college administrations. In the face of this cowardice, the revolutionary forces have repeatedly given public utterance to direct threats, exactly as Hoover pointed out. Every day come more.

The only way a campus disturbance can be handled is not to have it happen. This can only be done when it is understood that the communist timetable calls for complete disruption of American education, the press, art, literature, religion and morals. Even a cursory study of the scene will show that we are well along the road they have laid out for us. I should hate to believe that M.I.T. will go the way of hundreds of other colleges, treating student "unrest" as tempests in a teapot, ignoring the thoroughly adult and experienced revolutionaries who are at work.

If forthright countermeasures cannot be taken on campus for sheer delicacy and "reasonableness," how is there any future for education anywhere? It is time somebody faced that question honestly. The idea that if we turn our backs on reality our troubles will go away is absurd. What has become of the brilliant minds that made M.I.T. great?

David O. Woodbury
Ogunquit, Maine

Four Uncritical Horsemen

To the Editor:

The January, 1970, issue of *Technology Review* contains an article, "Smog's Four Horsemen" (pp. 72-73), that illustrates the degree to which even M.I.T. scientists can accept, uncritically, alleged "data" on air pollution and its effects. You quote the Union of Concerned Scientists' charge about the dust fall in Boston: "Left to itself, this stuff would soon cover the city to a depth . . . greater than most buildings." Even grammar school mathematics reveals the absurdity of this exaggeration.

The maximum dustfall cited, 200,000 lbs. per month per sq. mi., works out at less than 0.01 lbs. per month per sq. ft. Assuming a packed density of 100 lbs. per cu. ft. for settled dust, the arithmetic comes out at over 1,000 years per foot of dust accretion. The scale of time, in which the 20,000 or 30,000 years it would take to cover "most buildings" could properly be termed "soon," should be of little relevance in discussing our current air pollution problems.

Other conclusions offered by the U.C.S. would appear to be equally dubious although less susceptible to disproof by simple arithmetic because their premises have not been as explicitly stated.

This letter is not intended as a defense of air pollution, but as a plea for a rational and objective approach to the problems rather than an emotional approach that accepts without question the most obvious and patently erroneous allegations.

Kenneth D. Johnson
Vienna, Virginia

March Tech-Croscopic Solution

Carbon lends itself to the formation of polymeric compounds because of its fourfold chemical valency and its readiness to combine with itself and with small atoms such as hydrogen, nitrogen, and oxygen to form stable macromolecular substances.

—E. H. Andrews, *Fracture in Polymers*.

At Homericia we have helped over 51,000 relocating families select the communities and homes that best fit their particular mode of living. Choosing a home as far away as Hawaii can be just as easy as choosing a house in your own home town . . . if you do it the Homericia way. We know over 5,000 key communities intimately and we can tell you all you need to know to help you select those that are right for you. Then we'll screen them for

homes that best fit your particular requirements. After this is done, arrangements are made for you to inspect each one, limiting your problems to a selection only. A selection that is sure to be a happy one, not a nervous ill-informed one.



THE NATION'S LEADING RELOCATION SERVICE

HOMERICIA

A DIVISION OF HOMEQUITY, INC.

Write Dept. M

200 Park Avenue, New York 10017 (212) 661-3111
1901 Ave. of Stars, Los Angeles 90067 (213) 553-3111
500 N. Michigan Ave., Chicago 60611 (312) 527-3111

© 1970, Homericia

**Selecting a new home in New York,
Washington, California, or Canada can be as
easy as selecting the house next door.**



Printing and Copying
of Reports and Proposals

Computer Printouts
Reduced to 8½" x 11"

Dial C-O-P-Y-C-O-P
845 Boylston Street
Boston, Mass. 02116
(opp. Prudential Center)

THE PUTNAM ADVISORY COMPANY

*Offering
Specialized investment management
for
Pension and profit-sharing funds
Endowment funds
Other major portfolios*

A subsidiary of
The Putnam Management Company, Inc.
manager of the Putnam group
of mutual funds

265 Franklin Street
Boston, Massachusetts 02110

**Now
guaranteed
until
DECEMBER 31ST**

1976
~~1975~~



5% BLUE CHIP PLUS 90 DAY NOTICE ACCOUNTS

- Open your account with as little as \$500 and add deposits in any amount at any time up to a maximum of \$50,000.
- Earns **GUARANTEED RATE OF 5% PER ANNUM** through December 31, 1976 when funds are deposited.
- Interest is compounded **DAILY** from **DAY** of Deposit to **DAY** of Withdrawal.
- Free postage-paid bank-by-mail envelopes.



- Interest not subject to Massachusetts Income Tax.
- Make withdrawals in any amount without prior notice on the tenth day of January, April, July and October, or within the 7 days following one of these dates, if your money has been on deposit for at least 90 days.
- Or, you may make withdrawals on any date by giving a 90 day written notice.

YOUR CHOICE PASSBOOK OR STATEMENT ACCOUNT

Gentlemen: Please open a BLUE CHIP PLUS

☐ Passbook Account ☐ Statement Account
at the following Harvard Trust Office:

(please specify office nearest you)

NAME(s) (Please Print)				
ADDRESS	No. and STREET	TOWN	STATE	ZIP
Social Security No.(s)		SIGNATURES		

Mail to: P. O. Box 300, Cambridge, Massachusetts 02139

Enclosed is check for \$_____ to open a Blue
(\$500 minimum)

Chip Plus 90 day notice account which will earn interest at 5% per annum, compounded daily, from date of deposit to date of withdrawal guaranteed until December 31, 1976. I agree to the rules and regulations pertaining to this account.

☐ PLEASE SEND ADDITIONAL INFORMATION



"Your shortest path . . . to person-to-person banking."

HARVARD TRUST COMPANY

Cambridge, Arlington, Belmont, Concord, and Littleton.

Member F.D.I.C. • Federal Reserve System



M.I.T. CHAIR

Famed for quality craftsmanship, selected northern hardwoods, with gold M.I.T. shield, gold decoration on handsome black finish, the M.I.T. chair has earned the right to be a tradition. Choose black arms, \$41, or cherry arms, \$42. Red and grey Dura-leather covered cushion, \$11.



DIRECTOR'S CHAIR

Features the 3-color M.I.T. crest on the heavy white duck and black or natural varnish finish on the sturdy, foldable frame, \$17.95.



INSIGNIA GLASSES

The white Tech crest is fired on handblown quality glassware with platinum rim. Order Hi-Ball, \$1.15 each, \$12.50 per dozen or Double Old Fashioned, \$1.25 each, \$14 per dozen.



A good way to remember



PERSONALIZED PLAQUES

Cast bronze M.I.T. emblem is mounted on solid hand-rubbed walnut, shaped as a shield or rectangle (both 8½" x 11"). Graduate's name is engraved on the brushed sheet bronze nameplate. Engraving is filled with black inlay so letters appear in distinctive double outline style. Excellent gift idea. Order from Tech Coop. \$18.95.



SCHOOL TIES

The M.I.T. shield is woven in a repeated pattern on plain backgrounds of red, black or navy. Fine quality silk repp, \$5.

the Coop

M.I.T. Student Center
84 Massachusetts Avenue
Cambridge, Mass. 02139

PLEASE SEND:

- | | | | |
|---|-----------------|---------|---------------|
| <input type="checkbox"/> M.I.T. Chair with black arms | Express collect | \$41. | ----- |
| <input type="checkbox"/> M.I.T. Chair with cherry arms | Express collect | \$42. | ----- |
| <input type="checkbox"/> M.I.T. Cushion | | \$11. | ----- |
| <input type="checkbox"/> M.I.T. Director's Chair, Natural | Express collect | \$17.95 | ----- |
| <input type="checkbox"/> M.I.T. Director's Chair, Black | Express collect | \$17.95 | ----- |
| | | | Totals |

☐ Hi-Ball Glasses @ \$1.15 ea., @ \$12.50 dz. -----

☐ Double Old Fashioned Glass @ \$1.25 ea., @ \$14.00 dz. -----

Add 25¢ per glass, or \$1 per dozen glasses for shipping and handling.

☐ Red ☐ Black ☐ Navy Tie(s) @ \$5. ea. -----

☐ M.I.T. Plaque with nameplate \$18.95 -----

Graduate's Name _____

Class of _____

Please ship to: _____

Address _____

Zip _____

Ordered by: _____

Address _____

Zip _____

Coop # _____

Coop/Master Charge # _____

Coop/CAP Credit Card # _____

Check ☐ _____

Approx. 30 days delivery from Gardner, Mass., express collect, for M.I.T. Chairs. Add 80¢ for shipping and handling outside of Mass. on Plaques, Ties and M.I.T. cushions. Make checks payable to the Harvard Cooperative Society. Massachusetts residents: Please add 3% Mass. sales tax. (Out of state residents: No tax except when delivered in Mass.) Prices subject to change without notice.

TR-370

Institute Review

"The Evidence Warrants A Finding of Guilty"

M.I.T. took 25 of the young people who occupied the offices of the President and the Chairman of the Corporation on January 15 and 16 to court on March 10, and after less than a day of proceedings, the Court ruled that "the evidence warrants a finding of guilty" and set a nine-month probation period under Court surveillance for the defendants.

Judge Haven Parker of the Third District Court of Middlesex County continued the 25 cases which could be heard that day until November 5, 1970. All were charged with trespassing after a group broke a locked door with a steel pipe, entered the President's inner office, and occupied two adjoining rooms. Preparations to call in the civil authorities were in process when the group left, voluntarily, 34 hours after they entered (see *Technology Review for February 1970*, pp. 72A-D).

Still outstanding are three trespassing cases, four counts of disruption of classes (involving two individuals), and one case involving the manufacture of a burglarious instrument—the battering ram.

M.I.T. will proceed independently with disciplinary action concerning students who were involved in occupying the offices, says J. Daniel Nyhart, Dean for Student Affairs. Judge Parker made it clear in his ruling that the Court's action "in no way limits the actions which . . . the authorities at M.I.T. may desire to do under their own jurisdiction."

The morning session began on March 10 with the appearance of two dozen witnesses and more than 100 spectators as well as the 25 defendants forcing the session into a larger court. Even after the witnesses had been sequestered (on the grounds that hearing other testimony could be prejudicial in identifying the accused), there was not enough room for the spectators, who were mostly friends of the defendants. However, order was maintained despite noise from those waiting outside and interruptions and comments of three benchfuls of defendants. One objected to the portrait

above the bench as being that of a businessman; another was serenaded with "Happy Birthday," and a birthday cake was cut and passed—its recipients included the Judge.

By lunchtime, two witnesses had testified: Frederic W. Watriss, '41, Assistant Treasurer of the Institute, and Constantine B. Simonides, Assistant to the President, who began the testimony against the first defendant, Michael A. Albert, '70. There were no afternoon witnesses: immediately after lunch the Judge called all counsel to his chambers to discuss a proposed ruling.

Judge Parker's ruling means that if any of the defendants is found guilty in any Court between now and November, he can be sentenced under the trespassing charge without further trial. But if there is no further charge, the trespass charge will be automatically dropped on November 5. Unlike a simple Court continuance, the Judge has entered, on the record, a statement that a guilty finding is warranted; and he has also recorded his agreement with M.I.T.'s policy statement that this is not a "run-of-the-mill criminal trespassing case," that the office occupation was "a direct threat to the integrity of the institution and a serious challenge to the principles of openness and rational discourse and orderly process that are fundamental to any academic environment."

Before the trial, the defendants hoped to steal the stage in Court; advance leaflets urged the public to come and "see for yourself whether . . . the proceedings in the courtroom (are) your concept of fairness." Instead, it was the Judge's unusual ruling which aroused the most community interest.

Some felt the decision was a break for the defendants: they were not found innocent, but they were spared treatment as common criminals. Others who had hoped for a clear-cut conviction found the continuation too lenient. Many noted that the nine-month probation period would probably protect the Institute against further disruptive acts by the same group. A fourth view was that by "bending over backward" to be fair, the judge had taken the wind out of the

defendants' argument that American justice is not "your concept of fairness." At least he had reduced their visibility by cutting short a trial which would have been as highly "politicized" as the defendants could make it.

Inflation and the Money Gap: M.I.T.'s First Deficit in 38 Years

With prices rising and predicted income down, the Massachusetts Institute of Technology entered the 1970's in a bearish mood of caution—not yet ready to join the prophets of doom forecasting "the dark ages of technology" or the mindless dismantling of American science," but deeply concerned about the threat to the quality of American science and to our technological leadership in key areas.

The early years of this new decade will be a period of consolidation. For the first time in 25 years, restraints are being put on the system," says Paul V. Cusick, Comptroller. But M.I.T. academic programs, at least for the year 1970-71, for which projections are now essentially complete, will be "unimpaired," he emphasizes.

Every financial issue is measured in terms of both income and outgo. Here are the dimensions of M.I.T.'s problem, on the income side:

◇ For the fiscal year 1970, research contracts and grants to on-campus laboratories will remain essentially unchanged from the previous year; research funding will be reduced about 5 per cent in the Draper and Lincoln Laboratories and also in such major on-campus centers as the Research Laboratory of Electronics and the Bitter National Magnet Laboratory. Some of the on-campus reductions—and perhaps more in the future—stem from Congressional action requiring the military to justify as related to its mission all the research which the Department of Defense funds. The non-military agencies simply cannot pick up all the affected research quickly enough.

◇ An increase in tuition effective next June (see *Technology Review for October/November*, pp. 102-103) will yield an

There is a "funding brake" on U.S. science, says the National Science Board in its second annual "state of science" report; "the machinery of U.S. science is geared up to go much faster" than present commitments permit. M.I.T.'s experience, recounted in adjacent columns, is a case in point. "The real question for the nation," says Philip Handler, Chairman of the National Science Board, "is just how fast does it want its science to grow."

estimated \$2.3 million new income. But it will impose additional burdens on scholarship and loan funds.

◇ Gift and grant income from non-federal sources will at best be unchanged in 1970-71 from recent previous years. The Alumni Fund, which in general represents relatively modest gifts from many graduates, is slightly ahead of any previous record in donors but slightly behind in dollars. Beyond the area of annual giving, large individual donors have been caught in the uncertainties of both financial markets and federal tax law revisions; "monumental uncertainty" remains concerning the effect of the latter upon all forms of private philanthropy, according to Vincent A. Fulmer, S.M.'53, Vice-President and Secretary of the Institute. Foundation giving is not grossly imperiled by the new tax laws enacted by Congress late in 1969. But the prospects for large education-building grants are not high, Mr. Fulmer believes. Corporate support, traditionally higher—20 to 25 per cent of gift income—at M.I.T. than at other schools, will probably be responsive to uncertain business conditions.

Support for graduate students from non-M.I.T. sources is to be reduced. Research assistantships, which depend upon research funds, are imperiled by reduced research contracts. Traineeships offered by the National Science Foundation, the National Aeronautics and Space Administration, and National Institute of Health are being discontinued or reduced, though graduate students now enrolled with this support will usually complete their programs. Government- and industry-sponsored fellowships may be reduced in September, 1970, according to Irwin W. Sizer, Dean of the Graduate School, though the situation is not yet clarified.

Will graduate enrollment at M.I.T. next fall be reduced as a result? No one yet knows.

Dimensions of Inflation

Taken in all, M.I.T. is a \$212 million-a-year business, not including the annual additions to its physical plant and endowment. Considering only its on-campus teaching and research, the Institute's operations total over \$100 million annually. Inflation is the principal villain on

the cost side of M.I.T.'s future ledger:

◇ Superiority must be based chiefly upon competitive salaries and wages. Just to stand still, says Mr. Cusick, M.I.T. must probably give increases of 6 per cent and more (disregarding merit) just to cope with the increased cost of living in the Boston area in 1970—a \$2.5 million annual payroll increase for on-campus people, not including the Draper and Lincoln Laboratories.

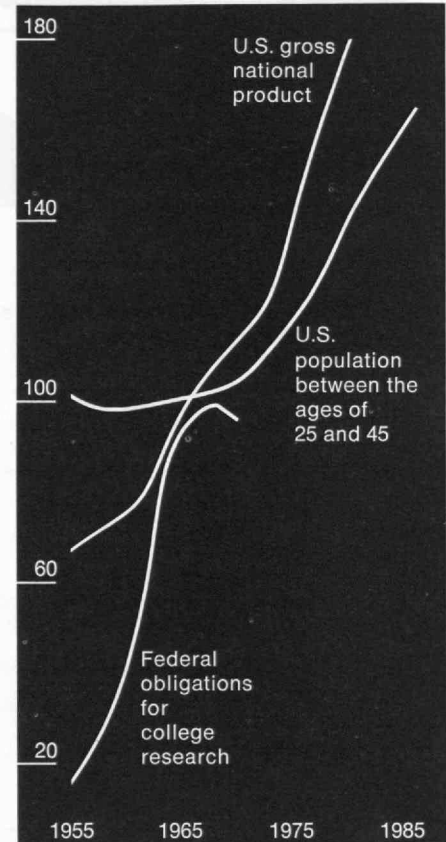
◇ Like everything else, the prices of the products M.I.T. buys are rising. In six months just preceding publication of this report, the Educational and Institutional Cooperative Service—a nonprofit organization to pool the buying power of nearly 1,500 schools, colleges, and universities—has posted price increases of 5 per cent on sheets and towels, 4 per cent on office furniture, 15 per cent on fluorescent lamps, and 5 to 10 per cent on blackboards, to list a few examples. Specialty items which M.I.T. purchases are going up even faster, according to G. Edward Nealand, '32, Director of Purchasing: electronic components, 15 per cent in one year, apparatus 10 per cent, metals 10 to 15 per cent.

◇ There is "severe" inflation in construction costs, says Paul Barrett, M.I.T. Construction Manager. Between 1969 and 1971 experts predict an increase of 1 to 1.5 per cent per month in the cost of typical university construction—perhaps more for complex work which includes laboratories and other special facilities. What would have cost \$3 million in 1969 must now be estimated at over \$4 million only two years later.

"If They Want It, Pay for It"

Put all together, what does this picture spell for M.I.T. in the first years of the decade? Austerity, restraint, and deficit are the words Mr. Cusick uses. But he insists that there will be—at least for the present—no impairment of present academic programs. New programs are another matter.

In the current fiscal year, normal expenses would have exceeded income by nearly \$2 million because of cost increases and unexpected reductions in research support. But departments and



administrative offices will find ways to save \$1 million, says Mr. Cusick, leaving a manageable shortfall which can be handled through current receipts. Examples: the Student Center library will be closed this summer; one of the three "campus banks" operated by the Bursar's office will be closed.

It will be the first deficit year for M.I.T. since 1932, Mr. Cusick says. For 1970-71, departments and administrative offices are being asked to find in savings on other operating expenses three-quarters of the salary and wage increases they will give their faculty and staffs. Mr. Cusick is confident that most departments will succeed, but he admits that this kind of strategy "can only work once without changing our way of doing things." If 1970-71 ends up with a \$1 million shortfall (read, "deficit to be made up from current funds"), 1971-72 will start from there; even without any further

inflation of costs over income, the cumulative deficit is presumably somewhere between \$2 and \$3 million by June, 1972. If costs continue to rise and income to falter . . .

For the longer term, Mr. Cusick simply says that the U.S. must somehow make some "major innovations in the support of higher education in the next decade. "If they want it, they've got to pay for it," he says.

A Chaotic Funding Dilemma

M.I.T.'s situation is simply an instance of a larger national problem. The House of Representatives' Subcommittee on Science, Research and Development has just received a report of its Research Management Advisory Panel which describes the present situation, arising out of the "Mansfield Amendment and—as well—out of more general priority changes, as a chaotic "funding dilemma."

"Today most universities in the U.S. are experiencing severe financial strains which threaten their very existence as economically sound national resources in the sciences," says the Panel report. "The strong bond connecting the government and the universities in postwar science is being progressively weakened."

President Howard W. Johnson, speaking to the Economic Club of New York late this winter, said that "even the optimist cannot clothe the financial problems of the universities in the guise of an opportunity. The problem is one of real gloom."

Speaking particularly of research support, Mr. Johnson reported that "the forward motion of science in our universities, which has meant so much to the progress of our nation, has ground to a halt. In some areas we are already moving backwards.

"We face drastic cutbacks by the Department of Defense, which since World War II has been a major source of our forward motion in all the basic fields of science and technology. If that framework of support is actually dismantled by the present Congress," declared President Johnson, "not only will the science departments of our universities suffer a body blow; so will the United States."

Alumni Fund Appointment

Martin M. Phillips, '47, formerly President of Growth Planning Associates, a consulting firm specializing in corporate planning, mergers and acquisition, and executive recruiting, has joined the M.I.T. Alumni Association staff as Associate Director of the Alumni Fund.

Mr. Phillips received undergraduate degrees in both mechanical engineering and business and engineering administration (1948) at M.I.T. and was for a number of years Director of Personnel and Engineering Services at the M.I.T. Instrumentation Laboratory. He became Executive Assistant at Itek Corp. in 1959, later was Vice-President of Tyco, Inc., and Vice-President and Director of BTU Engineering Corp. before founding his own firm of Growth Planning Associates. He is a member of Pi Tau Sigma, honorary mechanical engineering society.

Mr. Phillips will be concerned especially with regional activities of the M.I.T. Alumni Fund, according to Kenneth S. Brock, '48, director of the Fund, who announced Mr. Phillips' appointment.

Vice-President for Research, Draper Laboratory Self-Study

Albert G. Hill, Professor of Physics and Chairman of the Physics Council, who was the second Director of the Research Laboratory for Electronics and later served as Director of Lincoln Laboratory, has been named Vice-President for Research of M.I.T.

Under this new title, Professor Hill assumes responsibilities formerly held by the Vice-President for Research Administration and the Vice-President for Special Laboratories; the former position was vacated by Carl F. Floe, Professor of Metallurgy, in July, 1969, and Jack P. Ruina, Vice-President for Special Laboratories, has asked to resume teaching and research in the Department of Electrical Engineering.

In announcing Professor Hill's appointment, President Howard W. Johnson said that he will give "special attention to the broad policies governing sponsored research at the Institute to assure that the



M. M. Phillips



A. G. Hill

sponsored research program contributes effectively to M.I.T.'s educational aims." In addition, Professor Hill will have administrative responsibility for M.I.T.'s two off-campus "special laboratories," the Lincoln Laboratory and the Charles S. Draper Laboratory.

In connection with the latter, said President Johnson's announcement, Professor Hill will organize a study within the Draper Laboratory, paralleling similar efforts being made by the M.I.T. faculty and administration, to explore "optional courses for the future of that Laboratory and its relationship to the Institute. I have asked Professor Hill to seek the best judgment," said President Johnson, "drawing upon advice both from within the Institute and outside, about the desirability of continuing the present relationships and to analyze a variety of alternative plans for operation of the Draper Laboratory. . . . It is in this context that we are making a detailed study, for example, of some corporate format for the Laboratory that would be independent of M.I.T.

"I am confident that the results of this study will help us all understand more fully, in a practical way, what future courses are available to meet the best interests of the Laboratory and its personnel, the best interests of the nation, and the best interests of the Institute," President Johnson said.

The committee which Professor Hill has named includes David C. Driscoll, Assistant Director of the Division of Sponsored Research; George H. Dummer, Associate Director of the Division of Sponsored Research; Joshua B. Feldman, '40, Executive Officer of the Draper Laboratory; Lewis E. Larson, S.M. '47, Deputy Associate Director of the Laboratory; and Edwin H. Porter, Jr., '52, Associate Director of the Laboratory. Samuel A. Forter, S.M. '47, Associate Director of the Laboratory, will serve as Chairman of the committee, and Joseph F. O'Connor, Administrative Assistant to the Vice-President for Research, will be Secretary.

In his announcement, President Johnson called Professor Hill "one of M.I.T.'s ablest and most experienced teachers and administrators." He has been at

M.I.T. since 1937, following undergraduate studies at Washington University (St. Louis) and graduate work at the University of Rochester, and he held important posts in the Radiation Laboratory during World War II. Following the war Professor Hill helped organize the Research Laboratory for Electronics upon a new interdepartmental concept, and he served under Julius A. Stratton, '23, now President Emeritus of M.I.T., as Associate Director and later Director of R.L.E. In the early 1950's Professor Hill helped organize the Lincoln Laboratory to work on problems of continental air defense, and for several years he was Director of the Laboratory.

Wilson, Wilson, and Wilson

There's another Corning, N.Y., Wilson making records at M.I.T.—this time a sophomore, Benjamin W. In his first home appearance with the varsity basketball team this winter, Ben hit 17 out of 19 full goal attempts (a new M.I.T. record), and he ended the night against Brooklyn College having made 38 points—the second-highest one-game record in M.I.T. history.

Ben's brother, Alex Wilson, '67, holds the all-time M.I.T. scoring record of 1,224 points in a four-year basketball career; Richmond Wilson, '40, their father, starred for M.I.T. basketball in his years, too, once scoring one-third of his team's total points for the season. And Louis Wilson, '17, back another generation, was a stand-out middle distance runner for the M.I.T. track team.

Early in January only one M.I.T. varsity team—in wrestling—was undefeated. But the rifle team, having lost only to Coast Guard in ten meets, was regarded as the team to beat in the Greater Boston and New England Collegiate Conferences. And a freshman, David R. Wilson (no relation to Ben, above) had raised the M.I.T. freshman pole vault record three times in as many tries. His best was then 14 ft., only 6 in. less than the M.I.T. varsity record.

Minority Management Education

Nine leading U.S. graduate schools of management have joined in a program to enroll minority-group students under a \$1 million grant from the Alfred P. Sloan Foundation. The group will form the Council for Opportunity in Graduate Management Education, whose purpose is three-fold.

1. To increase minority group awareness of the relevance of master's degree programs in management as the professional-school link between undergraduate education and a management career.
2. To broaden the base of financial support for minority students through a program of graduate fellowships.
3. To help the participating schools sustain and strengthen existing programs for students from minority groups.

William F. Pounds, Dean of the M.I.T.

Sloan School of Management, said the grant is intended simply to sustain the Council through its first year of activity while substantially larger funds from other sources are sought. The Council's program is described as "a concerted effort to increase the flow of black and other minority persons into significant managerial positions."

The support represents the first major commitment under a new special program of the Sloan Foundation to improve the access of minorities to the professions of management and medicine. In addition to M.I.T., the consortium of schools joining in the Council include the University of California (Berkeley), Carnegie-Mellon University, Columbia University, Cornell University, Dartmouth College, Harvard University, the University of Pennsylvania, and Stanford University.

Hon. Ralph E. Flanders, 1881-1970

The Honorable Ralph E. Flanders, former U.S. Senator from Vermont who had been a member of the M.I.T. Corporation since 1937, died in Springfield, Vt., on February 19 at the age of 89.

In their resolution on his death, members of the Corporation cited Senator Flanders for "his kinship for the Institute (displayed) by a lively interest in new scientific and technological advances . . . and by his readiness to serve on numerous committees of the Corporation." In all, he had been a member of six different Visiting Committees during 20 years as an active member of the Corporation. Senator Flanders became a Life Member of the Corporation in 1940 and was made Emeritus Life Member in 1956.

Mr. Flanders was elected to the U.S. Senate from Vermont in 1946 and served two additional terms before his retirement in 1958. At the time of his election he was Chairman of the Board of the Jones and Lamson Machine Co., where he had worked for nearly 50 years beginning as an apprentice machinist. Though he had only seven years of formal education, Senator Flanders held 16 honorary degrees.

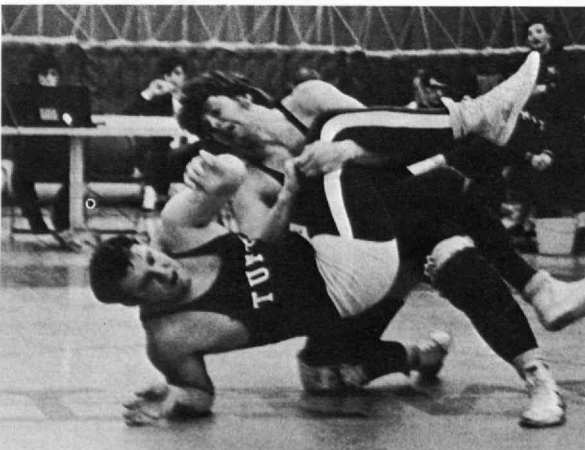
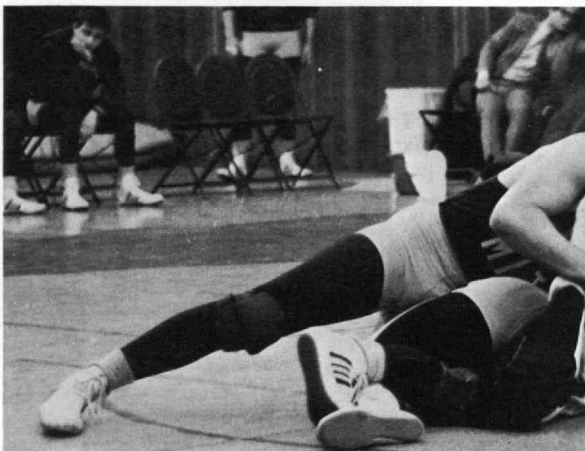
Wilson Fund in Management

The Irving W. Wilson Fund for Management Education and Research has been created at M.I.T. through a \$100,000 gift of the Alcoa Foundation.

A member of the M.I.T. Class of 1911, Mr. Wilson is a former Chairman of the Aluminum Company of America; he is also an Emeritus Life Member of the M.I.T. Corporation. The fund, which was announced at a dinner in honor of Mr. and Mrs. Wilson at the Duquesne Club in Pittsburgh on January 15, is unrestricted; it will be established in the M.I.T. Sloan School of Management for use in support of teaching and research.

Mr. Wilson studied in the undergraduate

After a slow start this fall, M.I.T.'s student photographers finally found their pace during the winter sports season. Intramural hockey action is fast and the photography difficult; wrestling is slower, but when to click the shutter is still the question that separates the men from the boys. In the bottom picture, Gary DeBardi captures the action seconds before Heavyweight Bruce Davies, '71, pins his Tufts opponent. (Photos: The Tech)



course in business and engineering administration, out of which has developed the present Sloan School of Management. Howard W. Johnson, President of M.I.T., called the fund "a most fitting tribute to 'Chief' Wilson's brilliant leadership of the aluminum industry and his outstanding record of public service."

"For years Mr. Wilson's name has been synonymous with Pittsburgh for legions of M.I.T. faculty, students, and staff," Mr. Johnson said. "The Institute has benefited tremendously from his presence and active participation in the governance of M.I.T."

Mr. Wilson joined Alcoa after graduation from M.I.T.; he became a Vice-President in 1931, President in 1951, and Chairman in 1957, and he was Chairman of the Finance Committee from 1960 to 1964 and has been a Director of the company since 1939. Meanwhile, Mr. Wilson was first elected to the M.I.T. Corporation as an Alumni Term Member in 1943, and he became a Life Member in 1951; he has served on several of the Corporation's Visiting Committees.

The Job Market for "Something Unusual"

Over 1,200 students who will receive degrees at M.I.T. this spring and summer have asked to be listed in the M.I.T. Placement Bureau's first compendium of "Graduating Students Available for Employment." Each has recorded a brief summary of his academic experience, and each has listed the fields in which he hopes to work and where he would prefer to live. The result is an interesting measure of America's changing—and unchanging—technological priorities.

"Guidance and Control, Systems Engineering" is the most popular of more than 50 categories in which students indicated employment interest: 66 M.I.T. students marked it among their "wants." Computers take second place: 58 students hope to work in computer systems, 51 in computer programming and numerical analysis.

No list made two years ago would have included urban affairs or ecology and pollution control, but no list this year can omit them. Of M.I.T.'s job hunters, 40 are interested in city problems, 30 in pollution control. Other leading fields of interest are management (general), 41; artificial intelligence, 40; and bioengineering, 37.

Surprises in the list: four students interested in law; seven in graphic arts, photography, and music; and 17 in high school teaching and education research. Another measure of the changing scene: two students interested in "Civil Engineering (General)," four in construction. And one, Stuart M. Schulman of Wantagh, N.Y., who will receive his bachelor's degree in June, was honest to a fault; he simply wants employment in "something unusual."

Alumni Election

Ballots on which alumni will elect national officers of the Alumni Association of M.I.T. for 1970-71 and representatives for five-year membership on the M.I.T. Corporation are now in the hands of more than 45,000 graduates of the Institute. Ballots must be returned by April 25.

Paul V. Keyser, '29, formerly Executive Vice President and Director of Mobil Oil Corp., heads the list as nominee for President of the Alumni Association. He has a long record of service to the M.I.T. Alumni Center of New York, of which he is currently Chairman, to the Alumni Fund (he is currently Chairman of its New York Advisory Committee), and to the M.I.T. Corporation, of whose Development Committee he is now a member.

Three alumni are standing for membership on the M.I.T. Corporation: Philip H. Peters, '37; D. Reid Weedon, Jr., '41, and Virgilio Barco-Vargas, '43.

Mr. Peters, who completes his term as President of the Alumni Association in June, is Senior Vice-President of the John Hancock Mutual Life Insurance Co. He has served in many capacities for the Alumni Association, the Class of 1937, and Alumni Fund; he was Chairman of the Alumni Fund Board in 1966-67 and continues as a member of the Board. Between 1960 and 1962 he served as Chairman for Area Organization of the M.I.T. Second Century Fund.

A leader in Boston public affairs, Mr. Weedon is Senior Vice-President of Arthur D. Little, Inc. He was President of the Alumni Association in 1961-62 and a member of the M.I.T. Corporation from then until 1967, and he has led many committees and other activities of the Alumni Association. Mr. Weedon is a Trustee of the Museum of Science and Chairman of the Massachusetts Commission on Ocean Management.

Formerly the Mayor of Bogota, Colombia, Mr. Barco-Vargas is now Executive Director of the International Bank for Reconstruction and Development in Washington, D.C. His career in civil service in Colombia spans much of the period since his graduation from M.I.T. in civil engineering, and he has been active in alumni affairs in that country.

Two Vice-Presidents of the Alumni Association are to be chosen; the nominees are A. Rufus Applegarth, Jr., '35, President of Aradar Corp. of Plymouth Meeting, Pa., and Kenneth J. Germeshausen, '31, Chairman of the Board and Director of Research and Development at Edgerton, Germeshausen and Grier, Inc., Boston.

Four alumni have been nominated to be Directors of the Alumni Association: James E. Cunningham, '57, Vice-President of Koch Venture Capital, Inc., Boston; Charles F. Langenhagen, Jr., S.M. '58, co-owner of Allaco Products, Inc.,

Braintree, Mass.; Leonard F. Newton, '49, Vice-President of Opinion Research Corp., Princeton, N.J.; and E. Alfred Picardi, '44, Partner in Perkins and Will of Washington, D.C.

In addition the ballot carries the names of five nominees for posts on the National Nominating Committee: Samuel A. Groves, '34, former President and Director of United Carr, Inc., Boston; Edward J. Norris, '31, Superintendent of the Portland (Me.) Water District; Robert S. Gillette, '36, President and Director of the Rock of Ages Corp., Barre, Vt.; Anton E. Hittl, '36, Product Manager of Union Carbide Corp., New York; and Roy F. Thorpe, '58, President of Fluid Handling Systems, Secaucus, N.J.



P. V. Keyser



P. H. Peters



D. R. Weedon



V. Barco-Vargas



A. R. Applegarth



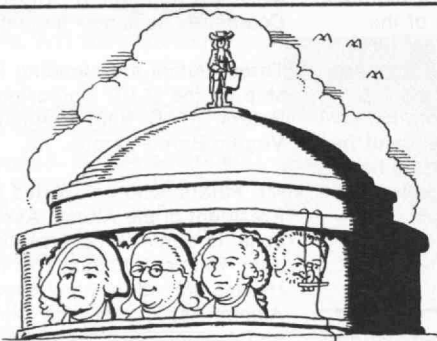
K. J. Germeshausen

WHO'S WHO IN ALUMNI CIRCLES



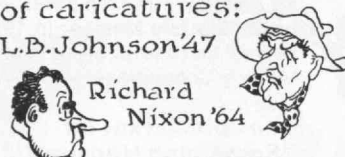
DID YOU KNOW that some of the most distinguished names in America's early political history are listed as your fellow alumni?.....names such as:

George Washington '25, Benjamin Franklin '69, John Adams, '27 et al, James Monroe '68, Alexander Hamilton '35, William Penn '37, James Buchanan '55



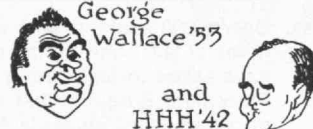
NO STATUES, no bas-reliefs for today's politicians...but plenty of caricatures:

L.B. Johnson '47



Richard Nixon '64

George Wallace '53



and HHH '42

MAYBE YOU DIDN'T KNOW about these fighters and patriots:

Robert E. Lee '58



J.E.B. Stuart '20

David Crockett '58

and Robert Bruce '44 or '66



OR THESE OTHER fighters (not necessarily patriots):

COMING!!
THE
COMPUTERIZED FIGHT
OF THE
CENTURY

John L. Sullivan '56

vs

Cassius Clay '48

PLUS
BATTLE ROYAL

Jim Jeffries '59

vs

Jack Johnsons
(WITH CROSS-WIRED
COMPUTERS)

MIT COMPUTATION CENTER
(Date to be announced)

SPRING BOOK LIST

M-I-T
A

NEW EDITIONS

• **COMPLETE WORKS**
of William Shakespeare '42

Comedies, tragedies, poems,
a mixed bag ~ but it's
Shakespeare's bag.



• **THE SCARLET LETTER**
Nathaniel Hawthorne '40

Lurid exposé of loose living in
Puritan New England (unexpurgated)



• **LEAVES OF GRASS**
Walt Whitman '17

One suburban gardener's
battle against weeds



• **THE LITTLE MERMAID**
Hans Christian Andersen '62

Lovely siren lures unwary
mariners to their fate on
Copenhagen rocks



OTHER TITLES BY:

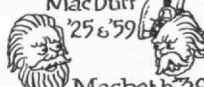
- Several Addison & Steele teams cover Spectator Sports
- One Robert Frost is great ~ we offer three!
- Plus SIX Robert Burns!!
- Oliver Goldsmith '39
- Thomas Wolfe '37
- John Keats '20
- Memoirs, Casanova '53 (now in preparation)
- Samuel Johnson '62, Life of.... awaiting only a Boswell ~
- Admissions Office alerted

AND PROBABLY you thought these were only fictional characters:

Gulliver '33
Peter Pan '67



MacDuff '25 & '59



Macbeth '39

THERE ARE Biblical names in profusion, lots of:

Adams, Eve (only one, Class of '41), Cains, Abels, Abrahams, Davids, Jacobs, Josephs, Sauls, Moseses, Samsons, Daniels, many more.



AND THERE IS A GOODLY
ARRAY of Saints (some recently demoted):

St. George, St. John, St. Peter, St. Paul, St. Jean, and others

AFTER ALL THAT you probably will not be surprised in the least to learn that Mohamed is Class of 1960

"Busy as the Devil"

At age 80, Vannevar Bush, '16, Honorary Chairman of the M.I.T. Corporation, fills his days with inventions, reading and writing. He is younger than many men three-fourths his age, and—by his own description—he's "busy as the devil!"

Robert Reinhold, Cambridge reporter for the *New York Times*, asked Dr. Bush in an interview on his birthday on March 11 about the new political activism of young people and of scientists. "If we had more people in the political show it would go better," was the answer.

How about the gulf between science and the military? "I've seen it happen before," he said. "It's not just the scientists—it's the general public attitude. . . . I think the military is too big now," he said. "I think we've overdone putting bases all over the world." And then Dr. Bush added a word on disarmament: "I don't think this ABM thing makes sense," he told Mr. Reinhold, "because I don't think the damned thing will work. We are on the verge of coming to an understanding with the Russians to tone down the whole thing and I think they are ready to agree. So we ought to tone down our emphasis on anything of that sort."

What would Dr. Bush do if he were a young man today? "I think I'd go into biology—it's where the things are happening. Some of the things the microbiologists are doing are really something."

Paul M. Chalmers, 1901-1970

Paul M. Chalmers, for many years a member of the Department of Humanities and more recently Associate Director of Admissions and Adviser to Foreign Students, died on March 12 following a long illness; he was 69.

Professor Chalmers was M.I.T.'s first foreign student adviser, having early recognized the special problems many foreign students encounter in seeking to study in the U.S. In 1944, when he began the assignment as "advocate" for M.I.T.'s foreign students, 250 young people had come from overseas to attend the Institute; in 1966, when Professor Chalmers retired, the number had swelled to 950, making M.I.T. one of the nation's leading schools in the percentage of foreign students.

"Professor Chalmers' office was always open to students," Howard W. Johnson, President of M.I.T., said in reporting his death to members of the faculty. "They appreciated his witty and literate conversation as well as his assistance in dealing with their problems."

Professor Chalmers held degrees from Brown University and had taught at the Peddie School, Lafayette College, and Brown before joining the Institute faculty in 1939 as a teacher of English. He continued as a member of the faculty in



P. M. Chalmers



E. E. Hagen



N. A. Phillips



R. H. Scott

English until 1954, and following his retirement from work in the Admissions Office he had edited the *M.I.T. Observer*, a newsletter for parents and members of the M.I.T. Educational Council.

In 1948 Professor Chalmers was influential in founding the National Association for Foreign Student Affairs, of which he was President from 1950 to 1952; and he was also founder of the Foreign Student Summer Project which, from 1948 to 1956, made it possible for many foreign students whose educations had been interrupted by World War II to continue studies in the U.S.

Acting International Studies Director

Everett E. Hagen, Professor of Economics and Political Science, has been named Acting Director of the M.I.T. Center for International Studies, to fill the vacancy left by the death on December 14 of Max F. Millikan, who had headed the Center since its founding in 1952.

Professor Hagen, an authority on economic and political problems of developing countries, came to M.I.T. in 1953, when his association with the Center for International Studies began. He had been Chairman of the Department of Economics at the University of Illinois in 1950-51 and then an economic adviser to the Union of Burma before coming to the Institute.

Professor Hagen studied at St. Olaf College and the University of Wisconsin. He served in various economic planning posts during World War II in Washington and later with the Bureau of the Budget, the Economic Cooperation Administration, and the Treasury Department.

Meteorology Head

Norman A. Phillips, Professor of Meteorology, will succeed Henry G. Houghton, S.M.'27, as Head of the M.I.T. Department of Meteorology upon the latter's retirement in June, 1970.

Professor Phillips, who came to M.I.T. as Research Associate in 1956, has specialized in research on the theory of atmospheric and oceanic motions. He

studied at the University of Chicago (B.S. 1947, M.S. 1948, Ph.D. 1951) and spent five years with the Theoretical Meteorology Project at the Institute for Advanced Study in Princeton, N.J. At M.I.T. Professor Phillips was made a member of the faculty in 1957, when he became Associate Supervisor of the Dynamical Weather Prediction Project, and he was appointed Professor in 1966.

Professor Phillips holds the Napier Shaw Prize of the Royal Meteorological Society (1956) and the Meisinger (1960) and Editor's Awards (1969) of the American Meteorological Society.

Professor Houghton, who retires from his administrative duties on June 30, 1969, has been a member of the M.I.T. Department of Meteorology since its founding in 1941 and Head since 1945. He was one of the founders of the National Center for Atmospheric Research and was the first Chairman of the University Corporation for Atmospheric Research which operates the Center, and he has made distinguished contributions in cloud physics and atmospheric radiation.

Information Processing Director

Robert H. Scott, '64, who has been Assistant to the Dean and later Assistant Dean of the M.I.T. School of Engineering since 1964, has been named Director of Information Processing Services at M.I.T., succeeding Richard G. Mills, '54, who will join the staff of the First National City Bank of New York.

Weston J. Burner, who came to M.I.T. one year ago as Assistant to the Director of Information Processing Services, will serve with Mr. Scott as Assistant Director and will also serve as Director of the Information Processing Center.

As Director, Mr. Scott will be responsible for "developing coordinated plans for the growth and interaction of the Institute's various computation services and information processing activities," according to the announcement by Jerome B. Wiesner, Provost. In addition to his duties with the School of Engineering, Mr. Scott has this year served with the Analytical Studies Group; he thus brings

to his new assignment "a thorough understanding of the Institute's capabilities and needs in this area," Dr. Wiesner wrote. Mr. Scott's M.I.T. degree is in political science.

Mr. Burner, who studied mathematics at the University of Pennsylvania (B.S., 1950), has had "extensive experience in industry, including the line management of computer service facilities and the management of applications programming—including the design of large information systems," according to Dr. Wiesner.

Commodity Transportation

A new interdepartmental group devoted to teaching and research on the technology and economics of transporting raw materials and processed goods has been formed at M.I.T. It is the result of planning by Alfred A. H. Keil, Head of the Department of Naval Architecture and Marine Engineering; Ernst G. Frankel, M.M.E. '60, Professor of Marine Engineering; and William W. Seifert, Sc.D. '51, Professor of Engineering.

Raymond L. Bisplinghoff, Dean of the School of Engineering who announced formation of the new Commodity Transportation and Economic Development Laboratory, said its main emphasis will be on teaching and research on effective commodity transportation systems—especially taken in the context of regional, national, and international economic development.

"Although commodity transportation has not been in the limelight of technological developments in recent years," Dean Bisplinghoff said, "it is easily recognized that solutions to commodity transportation problems generally provide the key to effective economic development or economic health of a region or a country."

Professor Keil said the laboratory will be problem-oriented, drawing groups of faculty, staff, and students together as required to work on specific real-world problems. Projects, he said, might include technological innovations in transport, forecasting the effects of new technology, using computer-based models to plan and test transportation systems, and development of a data center on world shipping problems.

Professor Seifert, an authority on systems analysis and control engineering, headed M.I.T.'s project on high-speed ground transportation from 1965 to 1968 (see *Technology Review* for February, 1969, pp. 34-39) and last year was in charge of an M.I.T. study of problems in transporting Alaskan oil to the East Coast (see *Technology Review* for February, 1970, pp. 69-70); and Professor Frankel has been working on new methods of ship construction and new plans for port facilities to integrate shipping with manufacturing and to make efficient use of new supertanker designs.

Alumni Calendar

Bethlehem—April 8, Wednesday, 2:00 p.m.—Tour of the Bethlehem Steel Company plant followed by dinner at Danny's Restaurant at 6:00 p.m. Movies of the Bethlehem Steel Company will be shown.

Boston—April 9, Thursday, 12:00 noon—Luncheon meeting, Aquarium Restaurant, Atlantic Ave. Speaker: Kenneth R. Wadleigh, Vice President, M.I.T. Topic: Reminisces as Dean of Students.

Chicago—April 18-19, Saturday and Sunday—Seminar, Center for Continuing Education, University of Chicago. Topic: Entrepreneurship and Management, including Technical Entrepreneurship, Finance, Marketing, Information Systems, etc. For further details contact the M.I.T. Alumni Association, E19-438, Cambridge.

Cleveland—April 2, Thursday—Concert by the combined Glee Clubs of M.I.T. and Mount Holyoke College.

New Haven—April 16, Thursday, 6:30 p.m.—Dinner meeting, Kline Biological Laboratory, Yale University. Speaker: J. Daniel Nyhart, Dean for Student Affairs. Topic: Student Discipline at M.I.T.

Northern New Jersey—April 25, Saturday, 9:00 a.m.—A guided tour of the Great Swamp, including areas normally off-limits to visitors. Picnic lunch will be served.

Norton, Mass.—April 17, Friday, 8:00 p.m.—M.I.T. Symphony Orchestra will perform at Wheaton College.

Philadelphia—April 19, Sunday, 4:00 P.M.—M.I.T. Symphony Orchestra will perform at Swarthmore College.

St. Louis—April 15, Wednesday, 6:30 p.m.—Dinner meeting, Stan Musial's Restaurant. Speaker: Dr. Cameron Meredith, Professor of Psychology at S.I.U., Edwardsville. Topic: A new approach to improving child-parent and child-teacher relationships.

San Francisco—May 2-3, Saturday and Sunday—Seminar, Stanford University Campus, Palo Alto. Topic: Entrepreneurship and Management, including Technical Entrepreneurship, Finance, Marketing, Information Systems, etc. For further details contact the M.I.T. Alumni Association, E19-438, Cambridge, Mass.

Tokyo, Japan—April 3, Friday—Dinner meeting. Speakers: Prescott A. Smith, '35, Professor of Mechanical Engineering and Oscar H. Horovitz, '22.

Washington, D.C.—April 4-5, Saturday and Sunday—Seminar, Center for Adult Education, University of Maryland. Topic: Entrepreneurship and Management, including Technical Entrepreneurship, Finance, Marketing, Information Systems, etc. For further details contact the M.I.T. Alumni Association, E19-438, Cambridge.

—April 20, Monday, 8:00 p.m.—M.I.T. Symphony Orchestra will perform at

Lisner Auditorium, George Washington University.

Class Reunions—June 12-14, 1970
Homecoming—June 14-15, 1970

Deceased

Charles R. Currier, '97, August 4, 1968
Jasper E. Crane, '04, December 1, 1969
Karl E. Peiler, '04, January 30, 1970
Robert W. McLean, '05, January 9, 1970*
Maxwell A. Coe, '06, January 27, 1970*
Allyn Taylor, '06, n.d.
Raymond J. Phelon, '09, October 24, 1966
Herbert W. Cummings, '10, July 6, 1969
Paul S. Hopkins, '10, December 16, 1969
John A. Bigelow, '11, February 8, 1970
Henry W. Van Hovenberg, '11, December 22, 1969
Pasquale F. Lombardi, '12, December 18, 1969*
E. Bruce Gotton, '13, February 25, 1970
Alexander Morrison, '13, December 31, 1969*
Albert V. DeBeech, '15, August 24, 1969
Abby W. Christensen, '16, October 6, 1969
Gordon M. Fair, '16, February 2, 1970
Herbert Gfroerer, '16, February 25, 1970
Edwin D. Reynolds, '17, December 1, 1969
Ernest H. Huntress, '20, February 1, 1970*
John M. Giles, '21, January 3, 1970
Albert J. Kiley, '21, February 4, 1970
Harold Kennedy Moritz, '21, December 9, 1969*
Charles J. Burke, '22, February 2, 1970
Harold E. Koch, '22, January 10, 1970
Edward B. Schwamb, '22, January 21, 1970
Manual M. Delugach, '23, February 11, 1970
Joseph Nissen, '23, March 8, 1970
Frank G. Fahrion, '24, January 16, 1970
Fred S. Hungerford, '24, October 10, 1969*
Robert P. Siskind, '24, January 10, 1970*
Samuel D. Waxman, '24, February 3, 1970
Theodore G. Coyle, '25, February 2, 1970
Clifton A. Jeffrey, '26, October 10, 1969
James T. Chirurg, '27, February 9, 1970
Jesse G. Nash, '27, January 5, 1970
C. Rogers McCullough, '28, January 13, 1970*
Abner G. Hertzmark, '29, December, 1965
Herford B. Southwood, '30, August 19, 1968
Frank W. Burwen, '32, January 12, 1970
Samuel W. Grossman, '33, January 27, 1970
Richard B. Collins, '36, September, 1967
Charles E. Trescott, '36, August 1, 1969
Robert C. Smith, '38, May 4, 1969
Peter K. Jungbluth, '39, January 19, 1964
Harry R. Bush, '40, October 5, 1969
Rodman F. Flinchbaugh, '42, October 25, 1969
Gregory Azarian, '43, February 21, 1970*
Morris I. Cohn, '50, March 6, 1970
John W. Nickerson, '50, October 20, 1969
David N. Walker, '57, February 1, 1970
Walter H. Pitts, Jr., '58, May 4, 1969
Byers G. Smith, '60, November 13, 1969
*Further information in Class Review.

Paul E. Dutelle, Inc.

Roofers and
Sheet Metal Craftsmen

153 Pearl Street
Newton, Massachusetts
02158

Swindell- Dressler Company

A Division of Pullman Incorporated

Engineers

441 Smithfield Street
Pittsburgh, Pennsylvania
15222

Charleston, West Virginia
Harrisburg, Pennsylvania
Chicago, Illinois
Toronto, Canada
Mexico City, Mexico
Sydney • Melbourne, Australia

Syska & Hennessy, Inc.

Engineers

Design-Consultation-Reports
Mechanical-Electrical-Sanitary
Elevator and Materials Handling

John F. Hennessy '24,
John F. Hennessy, Jr. '51

144 East 39 Street
New York, New York
10016

1720 Eye Street, N.W.
Washington, D. C.
20006

Lord Electric Company Inc.

Electric Contractors
to the Nation
Since 1895

New York N.Y., Medford, Mass.
Chicago, Pittsburgh, Portland, Ore.
Los Angeles, Richland, Wash.
San Francisco, San Juan, P.R.

Medford Office:
4080 Mystic Valley Parkway
(617) 396-9110

Science/ Engineering Alumni Magazines

Advertisers can reach
the alumni of 32 major
universities with a high
percentage of science and
engineering graduates
at discounted rates

For details write:
American Alumni Magazines
50 East 42nd Street
New York, New York
10017

Chas. T. Main, Inc.

Engineers

Studies and Reports
Design
Construction Management

441 Stuart Street
Boston, Massachusetts 02116
617/262-3200

1301 E. Morehead Street
Charlotte, North Carolina 28204
704/375-1735

Creative Professional Management, Inc.

Management Consultants

Quality Control
Manufacturing
Mechanization
Professional Placement

Wakefield, Mass.
(617) 245-8444

Polysciences, Inc.

Research, Development,
and Consultation in the
Fields of Polymers,
Monomers, Life Sciences,
and Medical Plastics.

B. David Halpern '43
Conrad Grundlehner '64

Paul Valley
Industrial Park
Warrington, Pa.
(North of Phila.)
(215) 343-6484

CONGRATULATIONS

to the
Class of 1970
from

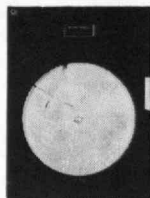
SPRAGUE & HENWOOD, Incorporated
Core Drill Manufacturers
and Contractors

Adrian E. Ross
President and Chairman of the Board
Class of 1934

Leroy W. Janson
Vice President, Engineering
Class of 1948

NORCROSS Viscometers

RECEIVERS



Electrical
Supply

To Measuring
Element

Indicating or Recording
Electric or Pneumatic Control
High and Low Alarms
Electric Output for Data Processing

MEASURING ELEMENTS for

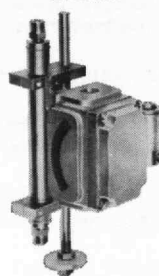
Open
Tanks



Pressure
Vessels



Side
Streams



In Line
Applications



Austin S. Norcross, '29 Frederick J. Eimert, '32 Robert A. Norcross, '51
for full details write Dept. A-69

NORCROSS CORPORATION Newton, Mass. 02158

Representatives in Principal Cities and Foreign Countries

albert

PIPE • VALVES • FITTINGS
Steel / Wrought Iron / Aluminum
Plastic / Stainless / Alloy

PIPE FABRICATION From one coded
pressure vessel to complete power plant pre-fabricated piping.

SPEED-LAY. Economical pipe system for oil-
gathering, dewatering and chemical processing lines.

PIPE PILING & ACCESSORIES
Composite pile extensions. Non-field welding H-Beam points
and sleeves.



WRITE FOR FREE BROCHURE:
ALBERT PIPE SUPPLY CO., INC.
Manufacturers—Fabricators—Distributors
101 VARICK AVE., BROOKLYN, N. Y. 11237
Telephone: 212 HYacinth 7-4900
S.G. ALBERT '29 • A.E. ALBERT '56

GEARS

**Designed and
Manufactured to Meet
YOUR
Production Requirements**

•
Custom Gears Exclusively
•

**DIEFENDORF
Gear Corporation**



Belden Ave. & Sand St., Syracuse, N. Y. 13201
(315) 422-2281

Abeles, Schwartz, & Associates

Urban and Regional Planning
Housing Development
Urban Renewal
Technical Assistance
Urban Research
Plant Location Studies
Land Utilization Analysis
Peter Abeles '56

10 Kenmare Street
New York, New York 11201
Telephone: (212) 966-0499

Brewer Engineering Laboratories Inc.

Consulting Engineers
Experimental Stress Analysis, Theoretical Stress Analysis, Vibration Testing and Analysis, Specialized Electro-Mechanical Load Cells and Systems, Structural Model Testing and Fabrication, Strain Gage Conditioning and Monitoring Equipment.
G.A. Brewer '38,
Marion, Massachusetts 02738
(617) 748-0103

Capitol Engineering Corporation

Consulting Civil Engineers
Robert E. Smith '41,
Edward W. Boggs '56
Dillsburg, Pennsylvania 17019

Cleverdon, Varney and Pike

Consulting Engineers
Structural, Electrical, Civil, Heating and Ventilating, Air Conditioning, Plumbing
112 Shawmut Ave.
Boston, Massachusetts 02118

Charles Nelson Debes Associates, Inc.

Engineers and Consultants
Structural, Electrical, Mechanical, Acoustical, Industrial, Commercial and Municipal Projects
C.N. Debes '35
915 East State Street
Rockford, Illinois

Fabric Research Laboratories Inc.

Research, Development, and Consultation in the Fields of Fibrous, Organic, and Related Materials
W.J. Hamburger '21
E.R. Kaswell '39, K.R. Fox '40,
M.M. Platt '42
G.A.M. Butterworth '61
1000 Providence Highway
(At Route 128 and US 1 Interchange)
Dedham, Massachusetts

Fay, Spofford & Thorndike, Inc.

Engineers
Boston, Massachusetts

Haley & Aldrich, Inc.

Consulting Soil Engineers

Foundation Systems Engineering
Engineering Geology—Seismic Surveys
Site Evaluation & Development
Consultation for Design & Construction
Earth Dam Design
H. P. Aldrich, Jr. '47 D. E. Reed '64
M. C. Murphy '51 J. J. Rixner '67
W. H. McTigue '54

238 Main Street
Cambridge, Massachusetts 02142

Jackson & Moreland

Engineers and Consultants
Division of United Engineers & Constructors, Inc.
Boston, Massachusetts

Kuljian

Engineers-Constructors
Utility-Industrial-Public Works
Power Plants (Nuclear-Fossil-Hydro), Transmission Systems (HV & EHV), Industrial & Processing Plants, Highways & Expressways, Airports & Facilities, Government & Institutional Buildings, Military Installations
H.A. Kuljian '19, E.J. Healy '24
A.H. Kuljian '48
1845 Walnut Street
Phila., Pa. 19103 Tel.: (215) 561-5300

Harold A. McCrensky Associates, Inc.

Management Consultants
Work Standards; Incentive Plans; Management Controls; Standard Costs
H. A. McCrensky '38, President
J. L. Gould HBS '37, Vice President
G. Beesley '39, Vice President
H. E. Jans '52, Senior Consultant
Park Square Building
31 St. James Avenue
Boston, Mass. 02116
Telephone: 617-542-2640

Metcalf & Eddy, Inc. Engineers

Boston • New York
Palo Alto • Cincinnati
Engineers and Consultants to Government and Industry
Water and Air Pollution Control
Water Supply and Waste Disposal
Transportation Facilities
Community Planning and Urban Renewal

Mueser, Rutledge, Wentworth & Johnston

Consulting Engineers
Foundations for Buildings, Bridges and Dams-Tunnels-Bulkheads-Marine Structures-Soil Studies and Tests-Reports, Design and Supervision
William H. Mueser '22,
Philip C. Rutledge '33
415 Madison Avenue
New York, New York 10017

Technology International Corporation

Applied Science
Technology Transfer
Wallace P. Boquist '54

Boston and Bedford
Massachusetts
Telephone: (617) 275-8424
Cable Address: INTECH

SIXTH ANNUAL TOUR PROGRAM—1970

This unique program of tours is offered to alumni of Harvard, Yale, Princeton, M.I.T., Cornell, Columbia, Dartmouth, and the Univ. of Pennsylvania and their families. The tours are based on special reduced air fares which offer savings of hundreds of dollars on air travel. The tour to India, for example, is based on a special fare, available only to groups and only in conjunction with a tour, which is almost \$400 less than the regular air fare. Special rates have also been obtained from hotels and sightseeing companies. Air travel is on regularly scheduled jet flights of major airlines.

The tour program covers four areas where those who might otherwise prefer to travel independently will find it advantageous to travel with a group. The itineraries have been carefully constructed to combine the freedom of individual travel with the convenience and saving of group travel. There is an avoidance of regimentation and an emphasis on leisure time, while a comprehensive program of sightseeing ensures a visit to all major points of interest. Hotel reservations are made as much as a year and a half in advance to ensure the finest in accommodations.

INDIA-NEPAL

28 DAYS \$1699

An unusual opportunity to see the diverse and fascinating subcontinent of India, together with the once-forbidden mountain kingdom of Nepal. Here is India from the mighty Himalayas to the palm-fringed Bay of Bengal: the great seaport of BOMBAY; the magnificent cave temples of AJANTA and ELLORA, whose thousand year old frescoes are among the outstanding achievements of Indian art; the unique "lake city" of UDAIPUR; the walled "pink city" of JAIPUR, with an elephant ride at Amber Fort; AGRA, with the Taj Mahal and other celebrated monuments of the Moghul period such as the Agra Fort and the fabulous deserted city of Fatehpur Sikri; the famed carved temples of KHAJURAHOO; the holy city of BANARAS on the sacred river Ganges; the industrial city of CALCUTTA; a thrilling flight into the Himalayas to KATHMANDU, capital of NEPAL, where ancient palaces and temples abound in a land still relatively untouched by western civilization; an exciting two day game viewing excursion to world-famous TIGER TOPS in the Himalayan jungle of Nepal; the great Indian capital of NEW DELHI; and the fabled beauty of the VALE OF KASHMIR amid the snow-clad Himalayas. Accommodations of unusual interest include hotels that once were palaces of Maharajas and luxurious houseboats on Dal Lake in Kashmir. Total cost is \$1699 from New York. Departures in February, August and October, 1970.



THE ORIENT

30 DAYS \$1649

1970 will mark the sixth consecutive year of operation for this fine tour, which offers the true highlights of the Orient at a sensible and realistic pace. As a special attraction, spring and summer departures will include a visit to the "EXPO 70" World's Fair in Osaka. Twelve days will be spent in JAPAN, divided between TOKYO, the FUJI-HAKONE NATIONAL PARK, and the ancient "classical" city of KYOTO, with excursions to NARA and NIKKO. A further highlight will be a comprehensive visit to the famous ruins of ANGKOR WAT in Cambodia, together with visits of 4 to 5 days in BANGKOK and HONG KONG and a shorter visit to SINGAPORE. Optional pre and post tour stops may be made in HONOLULU and the WEST COAST at no additional air fare. A complete program of sightseeing will include all major points of interest. Features range from a tour of the canals and floating markets of Bangkok and an authentic Javanese "Rijsttafel" dinner in Singapore to a launch tour of Hong Kong Harbor at sunset and a trip on the ultra-modern 125 mph express trains of Japan. Most tour dates include outstanding seasonal attractions in Japan, such as the spring cherry blossoms and beautiful autumn leaves and some of the greatest annual festivals in the Far East. Total cost is \$1649 from California, \$1828 from Chicago, \$1899 from New York. Special rates from other cities. Departures in March, April, June, July, September and October, 1970.

AEGEAN ADVENTURE

21 DAYS \$1299

This original itinerary explores in depth the magnificent scenic, cultural and historic attractions of Greece, the Aegean, and Asia Minor—not only the major cities but also the less accessible sites of ancient cities which have figured so prominently in the history of western civilization, complemented by a luxurious cruise to the beautiful islands of the Aegean Sea. Rarely has such an exciting collection of names and places been assembled in a single itinerary—the classical city of ATHENS; the Byzantine and Ottoman splendor of ISTANBUL; the site of the oracle at DELPHI; the sanctuary and stadium at OLYMPIA, where the Olympic Games were first begun; the palace of Agamemnon at MYCENAE; the ruins of ancient TROY; the citadel of PERGA-

MUM; the marble city of EPHEBUS; the ruins of SARDIS in Lydia, where the royal mint of the wealthy Croesus has recently been unearthed; as well as CORINTH, EPIDAUROS, IZMIR (Smyrna) the BOSPORUS and DARDENELLES. The cruise through the beautiful waters of the Aegean will visit such famous islands as CRETE with the Palace of Knossos; RHODES, noted for its great Crusader castles; the windmills of picturesque MYKONOS; the sacred island of DELOS; and the charming islands of PATMOS and HYDRA. Total cost is \$1299 from New York. Departures in April, May, July, August, September and October, 1970.

EAST AFRICA

21 DAYS \$1649

A luxury "safari" to the great national parks and game reserves of Uganda, Kenya and Tanzania. These offer a unique combination of magnificent wildlife and breathtaking natural scenery: a launch trip on the White Nile through hippo and crocodile to the base of the thundering Murchison Falls and great herds of elephant in MURCHISON FALLS NATIONAL PARK; multitudes of lion and other plains game in the famous SERENGETI PLAINS and the MASAI-MARA RESERVE; the spectacular concentration of animal life in the NGORONGORO CRATER; tree-climbing lions around the shores of LAKE MANYARA; and the AMBOSELI RESERVE, where all types of big game can be photographed against the towering backdrop of snow-clad Mt. Kilimanjaro. Air travel is used where possible, enabling longer stays within the parks. Also seen are the fascinating capital cities of NAIROBI and KAMPALA, the exotic "spice island" of ZANZIBAR, and the historic MOMBASA, a beach resort on the Indian Ocean, with its colorful Arab quarter and great 16th century Portuguese fort. Tour dates have been chosen for dry seasons, when game viewing is at its best. The altitude of most areas provides an unusually stimulating climate, with bright days and crisp evenings (frequently around a campfire). Accommodations range from luxury hotels in modern cities to surprisingly comfortable lodges in the national parks (some equipped even with swimming pools). Total cost from New York is \$1649. Departures in July, August, September and December, 1970.

Rates include Jet Air, Deluxe Hotels, Meals, Sightseeing, Transfers, Tips and Taxes. Individual brochures on each tour are available.

For Full ALUMNI FLIGHTS ABROAD

Details 145 East 49th Street

Contact: New York, N.Y. 10017

Class Review

Copy for this issue of *Technology Review* was due from your Secretary about February 16. News reaching him after that date will appear in the May issue.

95

At my request, Tyrrel Cheney tried via telephone to talk with **Luther Conant** and made two tries without success. He felt that Luther was too ill to be interested in visitors. Sorry to report this.

Had a letter from Frank Russell ("Patsy") which I quote: "You were an 'old man' or at least I thought so when I was initiated into OPE in 1907—so you can imagine my pleasure in finding the article in the 'NEWS'. I'm proud of you! It would give me great pleasure to entertain you at lunch, the next time you come to New York!" Thank you, "Patsy", but this *really* "old man" does not get to New York these days.—**Andrew D. Fuller**, Secretary, 1284 Beacon St., Brookline, Mass. 02146

96

Herbert D. Newell, Course I, died November 19, 1969, as the result of a car-train accident, his son Herbert Newell, Jr., reports. A car he was riding in was hit by a train and he suffered severe contusions. He was born on a farm near Hampden, Mass., went to the Wilbraham Academy and graduated from M.I.T. as a civil engineer. He conducted a relocation survey for the Erie Railroad, worked on the Boston subway and went to Oregon in 1902 to supervise repair work for the U.S. War Department at Ft. Stevens.

In 1903 he transferred to the U.S. Reclamation Service and was project manager of the Umatilla Irrigation Project, Hermiston, Oregon, until 1918. He married Effie McBroom in 1905 and had one son, Herbert, Jr., who is a lawyer in Fresno, California. In 1919 Mr. Newell was assigned to the Klamath Irrigation Project at Klamath Falls, Oregon, and served 13 years. In 1933 he did research work in Vicksburg, Miss., on the Red River.

He moved to Portland, Oregon, and retired from professional duties except for an engineering assignment on the wharf at The Dalles, Oregon, in 1936. He lived alone following his wife's death in 1945 until he moved to Fresno to be with his

son at age 90. He was in good health and corresponded with many friends until his accident in October, 1969.—**Clare Driscoll**, Acting Secretary, 11 Cliff St., Plymouth, Mass. 02360

03

William O. Eddy, Course IV, of Salinas, Calif., humorously prefaces his mixture of family and personal chronology with his "awaiting obit." He does not regret growing old: "It is a privilege denied to many."

William was born on March 18, 1881, in Providence, R.I. William's mother was a Cushman, a direct descendant of Elder Cushman, whose only son, Isaac, married Mary Allerton, the youngest member of the Mayflower party to land at Plymouth Rock in 1620.

During William's early school days, he, with his brother Harold, '07, would accompany their grandfather to the yearly Bridgewater County Fair. They started early in the day by horse and buggy but on arrival were more interested in horse racing than agriculture. Their appetite later was gratified by the crude sign: "All you can eat for 20 cents. Menu: Baked Beans and Brown Bread, Corn Beef Hash, Coffee and Milk and a big wedge of Boston Cream Pie."

In due course, William was graduated from Middleboro High School in 1898 and being too young for college, entered private school, taking subjects that eliminated some first-year courses on entering M.I.T. Class of 1903. At Graduation he was awarded a B.S. in electrical engineering which his chum, Earl Ovington, the first man to fly the U.S. mail, proclaimed to mean "Barely Saved."

Bill's memory is keen on college days and he can still hear Professor Cross with his annual joke to the Freshman Class, over the Williamhurst Static Machine.

After graduation he went to Schenectady, N.Y., to join General Electric Company's Testing Department, along with classmates Andrey Potter, Charlie Glenn and Bill Mitchell, a tycoon in the electrical power field until his demise.

In 1906 William was employed by the Petroleum Rectifying Company of California. While there he secured 10 patents pertaining to the electrical process of dehydration, refining and desalting of petroleum products. Some of these methods are still in use. His work continued in the oil field until the depression in 1930. He then retired to farming until 1936.

The urge to resume his activities in the electrical field is seen later in his work as chief of an irrigation and power plant project in California. This work has since become of inestimable value to the whole area, whose population now surpasses that of New York. His stay in Salinas so endeared him to that area that he has now retired to enjoy its rich soil and soothing temperatures.

We regretfully report the death on January 11, 1970 of **Charles L. Bates**, Course VI, of Vancouver, B.C.—**John J. A. Nolan**, Secretary-Treasurer, 13 Linden Ave., Somerville, Mass. 02143

04

Virtually all the news this month concerns deceased classmates. We regret to report the passing of **Karl Peiler**, of West Hartford, Conn., **Jasper Crane**, Wilmington, Del., and **Daniel Comstock**.

We have also received word that Mrs. Louis Bouscaren has passed on. Your Secretary regrets to report that he lost his own wife, Mrs. E. H. Russell. Further information will appear in the next issue.—**Eugene H. Russell, Jr.**, 82 Stevens Rd., Needham, Mass. 02192

05

Since our last writing I have received further news from classmates. **Bob Beard** writes, "Greetings to all. Health good. Going strong—have three great grandsons." He sends pages from a brochure showing instructions on drawing "The Five Star Insigne" which he sent to General Eisenhower in November 1945 (and a copy of the letter from General Eisenhower, acknowledging the contribution). I wish I could show the instructions and de-

sign, for they are extremely interesting. Bob also sends me a clipping from the *New York Times* of October 30, 1939, commenting on a spiral ramp design proposed by R. S. B. at the Governor's Island Conference between Ole Singstad, Engineer, Triborough Bridge Authority, and General T. A. Terry: Pier 150 feet high; Ramp 210 feet in diameter; Grade 6 percent. Bob concludes, "November 2, 1969. Both Governor's Island and the Brooklyn Navy Yard are now closed and this bridge, costing half as much as the tunnel, would have made possible Mayor LaGuardia's dream of a Governor's Island Heliport at New York's front door." Apparently Bob did not have the proper political approach (not ramp).

Gilbert Tower has a new thing going. He is writing a column for a local newspaper on town matters, planning, zoning, apartments, buildings, etc. Any by-line, Gib? . . . **Harry Kendall** sends a card showing the Ala Moana Center, Honolulu, where the Kendalls spent the months of January and February. "Arrow marks the spot," and the spot is a ten story apartment way out on a cliff almost in the Pacific Ocean.

Bill and Peg Ball in their Christmas letter announce that they have finally settled—listen: "We find ourselves, this Christmas in a modest house in a semi-tropical setting and in a quiet neighborhood with all necessary facilities. We call it 'Sweet-home,' which is the way we thought of our Cotuit home. Events have moved swiftly since last June when we slept here on army cots until our furniture arrived on the fifth. (Army cots look comfortable but that is all!) Our close neighbors, whom we now call our friends, have been wonderful to us." Bill will soon begin his travelling-secretary duties interviewing '05 men in Florida, not too arduous a schedule, as there is only one other '05 man living permanently in Florida—**Warren Wells** of Orange City.

Sadly, I report the death of our Class Agent, **Bob McLean**, who died on January 9, 1970. Bob had represented us faithfully as Class Agent for many years. Our record, both as to volume and percentage of class participation, has been high, and due to Bob's sensible and regular appeals (he wrote his own copy). You all know much of his history; he was always on hand and very helpful at class reunions, constant in attendance at Alumni Day luncheons. However, I am quoting from an obituary in a local newspaper: "West Bridgewater. Robert W. McLean, 89 of North Elm St., formerly of Bridgewater, died Friday in the Goddard Hospital, Stoughton, after a brief illness.

"Born in Malden, he was educated there and in 1905 graduated from M.I.T. From 1905 to 1907 he was an instructor at M.I.T. and served as a councilman in Malden. In 1908 he moved to Bridgewater to manage the Carver Cotton Gin Co., where he remained until 1917.

"From 1917 to 1945, he was employed by the United Shoe and Findings Co. of

Whitman. He was a member of the Bridgewater Fellowship Lodge, AF & AM, and Harmony R. A. Chapter; also the Bay State Commandery of Brockton and the American Society of Merchant Engineers. . . . He is survived by his widow, Jennie (Kingston); and a brother, Phillips B. of Anchorage, Alaska."

Bob was always full of jokes, often on himself. I remember his telling of an experience when visiting his home office (Carver Cotton Gin Co. in New Orleans, I think). As he entered the office, a man of about his age was leaving. Bob stopped him, "Seems I ought to know you." They identified themselves—the other fellow as **Jim Barnes**, Course VI. Bob told me later, "We had a wee bit of a celebration." He was a great guy, and I liked him a lot.

Incidentally the last report on the current Alumni Fund shows that our contribution to date is almost as much as the total of all previous classes, our percentage of participation 39 percent. Let's up the latter in memory of Bob's faithfulness.

Izzy Nye continues to be our most faithful picture post-card correspondent. Last month a card from Cape Cod; recently one from Pass-a-Grille Beach, Fla. Izzy seemed to be sitting beside a swimming pool, watching—and plenty to watch. . . . So far I have received no suggestions as to how to celebrate our 65th reunion. Shortly you will receive a letter asking some questions, which must be answered.—**Fred W. Goldthwait**, Secretary, Box 32, Center Sandwich, N.H. 03227; **William G. Ball**, Assistant Secretary, 6311 Fordham Place, Bayshore Gardens, Bradenton, Fla. 33505

06

Regretfully, you didn't find any '06 notes in the March issue so here is a tardy thank you for those nice Christmas cards, many with welcome messages, and special mention goes to the Review staff. Early in November a note came from Mrs. Horace Ford: "Please extend to the members of the Class of 1906 my deep appreciation for their kind expression of sympathy."

Edwin B. Bartlett, Course VI, confesses that he reads the class notes with great interest, and referred to our reunions on the Cape and in Boston. Ed got his degree from the University of Wisconsin before he joined us and got another one. He says he found he was better at talking than engineering so he bought half of a small business—in Milwaukee—that made some money in W.W.I. Ed sold out in 1944, so has been retired for 25 years. He and Mrs. Bartlett continue in good health and spend the winter months in Phoenix as they have for many years.

John Wrinkle, Course IV, and his wife still live in the small town of Mill River in the Berkshires and spend winters at Daytona Beach at Casa Blanca. A son

drives their car down so they get around.

Jim Wick, Jr., Course II, on his card reported that his wife, Clare, had been in the hospital for some months. He goes to see her frequently, and their two daughters, Mary and Harriett, keep an eye on her too. Son Warner and his wife and Emily ('51—M.I.T. Professor) were there for the holidays.

Howard Barnes, Course I, and his wife Margaret, have found Plymouth streets so full of traffic during recent summers that it was hazardous to venture forth. Imagine what it will be like this summer when Plymouth observes its 350th! Will you be there? . . . **Henry Mears**, Course III, writes that he is really retiring and moving into an apartment—No.1121—1717 S.W. Park Ave., Portland, Oregon, 97201. In a note to him I asked Henry what he did for exercise—walk up eleven flights of stairs.

In the note on his card, **George Guernsey**, Course I, referred to the death of Allyn Taylor and of Sherman Chase and their strenuous and useful lives. George continues to lead the Life of Riley at Sarasota though he does get some exercise lawn bowling and with the shuffle board, etc. . . . **Jack Norton** and Margaret continue to keep well up there in Tryon, N.C. He referred to Sherman's passing and his very successful life and career. He remembered that the house in which Bertha Chase continues to live, in Auburndale, was "only a short stone's throw from where I was brought up and lived until I was 15." . . . **Bob Cushman** has been collecting pictures of ships for some years and I recently sent him a few that appeared in the Boston papers.

Just as these notes were being typed, came a note from Maxwell D. Coe that his father, our classmate, **Maxwell A. Coe**, Course II, had died January 27. Max was born November 10, 1884, in Omaha, Neb. While at Tech he lived in Medford; was very active in sports, on relay and track teams; was a member of Walker and Civics Clubs, M. E. society, and Osiris; was vice president of the Class our sophomore year and president senior year; served as editor-in-chief of *Technique* 1906; and was president of the Institute Committee and on the Class Day Committee to mention some of his activities. His entire business life was in the hardware business; he became vice president and general manager of the Stanley Rule & Level Co. In 1914 he married Ethel May Norton. A note of condolence from the Class has been sent to his son.

Marion and I continue to keep well and busy—**E. B. Rowe**, Secretary-Treasurer, 11 Cushing Rd., Wellesley Hills, Mass. 02181

09

In the news of the sixtieth reunion appearing in the 1969 October-November number of the *Review* we reported that

Mex Weill and his granddaughter were in attendance but there was no opportunity to learn in any detail of his current activities. In the May 1968 issue we described in some detail the business operations of Skydyne, Inc. of Port Jervis, N.Y. when Mex was chairman of the Board. Over the years he had developed Skydyne into a successful corporation, its principal business being the design and production of containers for the housing and transport of delicate scientific equipment in large measure for N.A.S.A. and for satellites being built for M.I.T.

On request for further information Mex writes: "I evidently did not make myself clear at the Reunion as I intended to tell you that I am no longer chairman of the Board of Skydyne. Since we were merged with Brooks & Perkins of Detroit, that office has disappeared. As matters now stand, my son, Robert, is president of Skydyne and I am his adviser. Our activities at Skydyne continue much as they were but to a lesser degree due to government economy program. However, we seem to be busier than ever working with the engineering staffs of a number of large prime contractors. I cannot allow this letter to go forward without telling you how much I enjoyed being at the Reunion and refreshing relations with my classmates there. My granddaughter, Arden B. Weill, enjoyed meeting the classmates at the Reunion so much and has referred to it several times in our correspondence. She likes Boston and lives and works there. She is with the Putnam Fund Group. She is an excellent skier and enjoys those activities in her leisure time." Many of us still remember Mex as a member of the band in our freshman regiment—drum major, as we recall.

Recently the present Administration decided to terminate the N.A.S.A. research center which was established some four years ago near Kendall Square, Cambridge. At the time, its location was considered highly advantageous because of its access to the scientific talent of nearby M.I.T. and Harvard, as well as that of the many electronic industries which are located in the surrounding territory. Two buildings had already been completed and two more partially so. Over 800 scientists, technicians, and others were employed. When completed the center would have been a great asset to the economy of Cambridge and its environs, and its closing will be a great blow. Naturally there were vigorous protests from scientists, government officials, and others.

Among those protesting was **Brad Dewey**, who now lives on Memorial Drive nearby. In separate letters appearing in the *Boston Herald-Traveler* and the *Boston Globe*, titled "Defense Research Slash Opposed" and "Research Vital", he stated that normally he was "a great rooter for cutting down expenses. But this time I am horrified at the terrific slashing of scientific research appropriations. . . . M.I.T. will probably be the

hardest hit having \$16,900,000 at stake." As many will recall, Brad was in charge of the synthetic rubber program during World War II. He states that the Secretaries of War and of the Navy did not know how we could have played our part in winning the war had it not been for the "research power houses," meaning the universities, that so enthusiastically loaned these facilities. We are all glad to hear from Brad again.

We have received a clipping from the *Star of Delray Beach, Fla.*, telling of the death of Mrs. Rose F. Main on January 5. Rose was the widow of our first class secretary, Charles R. Main. She leaves a son, Charles T. Main, II, of Charlotte, North Carolina, and was the mother of the late Samuel Frost Main and the late Doris Woodman Main. The services were held in Winchester, Mass., where Rose, as well as the Main family lived for years. Charles was the son of Charles T. Main, who founded the well-known engineering firm which bears his name, and he was also an honorary member of '09. Alice, Charlie's sister, still lives in Winchester and continues her interest in community affairs.—**Chester L. Dawes**, Secretary, Pierce Hall, Harvard University, Cambridge, Mass. 02140; **George Wallis**, Assistant Secretary, Wenham, Mass.

10

To all Members of the Class: have received from **Jack Babcock** the preliminary program for our 60th reunion. Returns from this show that we should have between 30 and 40 members of the Class present at the reunion in June. You will have received final notice of the reunion by the time you see this in the *Review*.

Max C. Sherman: "Still living, as we have for thirty years at Newmont Farm, Claremont, N.H.; 60th anniversary next year, with 11 grandchildren and 13 great-grandchildren. Don't like S.D.S."

Mr. Walter Petersen sent me a copy of *Vortex*, a publication from the California Section of the American Chemical Society, giving a report of classmate **Ludwig Rosenstein**. Mr. Petersen said, "Dr. Rosenstein is a highly honored member of our Section, not only because of his outstanding career accomplishments, but also for his dedication to the problems of mankind." The article in *Vortex* follows: "Ludwig Rosenstein has served California Section for many years. Forty-three years ago he was elected secretary of our Section, which post he held for eight years. For two years, 1937-38, he served as councilor and since 1949 he has served continuously as a Section trustee. Dr. Rosenstein's undergraduate days were spent at M.I.T. He was one of G. N. Lewis' first doctoral candidates. Then followed two years at M.I.T. as instructor, a career he never fully forsook, for as late as 1932 he was a special lecturer at U.C. and in 1933-34 and 1941 he served similarly at Stanford. In the intervening and subsequent years

he was employed at Great Western Electro Chemical Company in Pittsburgh where he preceded Wilhelm Hirschkind, another fifty year honoree, as Chemical Director. From 1926 to 1931 he was a consultant with Shell Oil. From 1931 to 1941 he was employed by Shell Chemical. It was at that time that he studied the direct use of anhydrous ammonia for the fertilization of field crops. Dr. Rosenstein is the holder of somewhere between 75 and 100 patents, both American and foreign. This though, is only one side of his life for he is an accomplished painter and sculptor."

I have been notified that **Guy H. Little** died on June 10, 1969.

Stanley C. Dunning, Secretary of the Class of 1917, sent me a letter telling of **Frank Bell's** activities as a skater.

Frank, as we all know, was physically active until the time of his death. I don't believe any of us realized his proficiency in figure skating. The following notice tells of a memorial trophy established in Frank's name: "I saw recently in *Skating Magazine* (official publication of the U.S.F.S.A.) that the Dallas Figure Skating Club has presented to the U.S.F.S.A. a trophy, 'General Frank F. Bell Memorial Trophy for Novice Men in Southwestern Championships.' "—**Herbert S. Cleverdon**, Secretary, 112 Shawmut Ave., Boston, Mass. 02118

11

The Alcoa Foundation of the Aluminum Company of America has given M.I.T. \$100,000.00 to establish an **Irving W. Wilson** Fund for Management Education and Research. President Howard W. Johnson said the fund, which is unrestricted, will be established in M.I.T.'s Alfred P. Sloan School of Management for use in support of teaching and research. "The fund is a most fitting tribute to 'Chief' Wilson's brilliant leadership of the aluminum industry and his outstanding record of public service," President Johnson said "For many years his name has been synonymous with Pittsburgh for legions of M.I.T. faculty, students and staff. The Institute has benefited tremendously from his presence and active participation in the governance of M.I.T."

Irving was born in 1890 in Bloomington, Ill., graduated from the Bloomington High School and from Tech in Course XIV. He was a member of the Class Day Committee. He joined Alcoa after graduation, became vice president in 1931, president in 1951 and chairman in 1957. He was chairman of the finance committee from 1960 to 1964 and has been a director of the company since 1939. He became an alumni term member of the M.I.T. Corporation in 1943 and a life member in 1951. He served as a member and chairman of visiting committees for physics, metallurgy, aeronautics and astronautics and naval architecture, and on the standing committee on membership.

Edward Kenway was killed instantly when struck by an auto while crossing the street in front of his daughter's home in Sudbury. A letter from his daughter, Mrs. Cynthia Wyeth, says "He died at a time when, in spite of crippling arthritis, he had to use a cane, he was still mentally alert and enjoying life to the full. He saw one friend or another daily, loved his new car and was out in it every day. He had been well enough to enjoy six weeks at his beloved Maine home." Edward had skied and played tennis until he was 76. He collected and studied Japanese prints for many years and was an authority on the subject. Kenway, 81 years old, had been sales manager of the United Shoe Machinery Corp., and was a member of Eliot Church in Newton, DeCordova museum in Lincoln, Boston Fine Arts Museum, Salisbury Mansion Associates in Worcester and the Boston Badminton and Tennis Club. He leaves a brother, a sister, three daughters and nine grandchildren.

I have a few notes that were returned with donations to the Alumni Fund. From **Robert E. Morse**: "No report, retired 15 years." . . . From **Livingston P. Ferris**: "General supervision Ashton Plantation, 1,000 acres, cotton, soybeans, woodland, cattle." . . . From **Willis K. Hodgman**: "Am still associated with Hodgman Manufacturing Co., Inc. in a fairly active capacity, mostly in connection with production and improving the items we make; also work on new devices. My health is reasonably good but find I tire rather quickly." . . . **Harry Tisdale**, whose life story appeared in these notes last month, was in a collision with a Cadillac resulting in a cut lip that made eating painful for quite a while. His car was damaged to the extent that he now has a new one.

A recent letter from President **Howard Williams** tells of an effort he is about to make to get wider participation by the Class in the Alumni Fund. It may be that you have received a letter from him on the subject before you get these notes. If so let this be a reminder to do as he wishes if you have not already done so. . . . A Christmas card from **Paul Cushman**, signed by Nell and Paul, had this message: "We both work—busy and happy—live comfortably here in my home."—**Oberlin S. Clark**, Secretary, 50 Leonard Rd., North Weymouth, Mass. 02191

12

DO YOU REMEMBER the restaurant in Chinatown where we could obtain an enormous order of chop suey for 25 cents. One night, as freshmen, a group of us were required to eat two full orders, washing it down with Chinese tea. And after that the dark!

At long last, we have been successful in securing from our class president, **Albion Davis**, the story of his activities since 1912. Here it is. "After graduation, **Harold Mabbott** and I went to work with the Peerless Motor Car Co. of Cleveland.

This company made a premium product and their engineering standards were of the highest. It was a good experience for a chap not yet dry behind the ears. I found that I was well equipped with the basic knowledge and was able to make at least a limited contribution to the picture. At this time electric headlights were replacing the old acetylene lamps, and engine starters were being considered as a possibility.

"I was fortunate enough to be assigned to these projects, and several of my ideas were patented. Our progress in this field led to an offer by Gray and Davis of Boston for the chief engineer of Peerless to work with them on a broader basis. An electrical engineer and I were invited to accompany him. Here I served as chief draftsman, but this position lasted only a short period and I was looking for a new job. I went with Wentworth Institute of Boston as an instructor, and also developed several commercial outlets for their shop facilities. During the summer months, I took a temporary job with Stone & Webster, Boston, as draftsman but soon I was offered a permanent job as field engineer. Then I was transferred to their central planning and control department, where I served until World War I. I was then transferred again to their procurement department, working with materials and equipment for the various new arsenals and extensions in which they were involved.

"I travelled through the East and Middle West, locating scarce items and expediting manufacture and shipments. I also worked with the Ordnance Department on similar work, and was involved in liquidating certain Government commitments with some large contractors. After the war, I was general superintendent at the Watertown Arsenal, cleaning up unfinished war production.

"For some time I had been intrigued with the important part held by money in relation to engineering. Projects were often cut, changed or possibly abandoned for financial reasons. The engineer seldom had the last word. I accordingly decided to attempt a break into the financial field. I joined the staff of Scoville, Wellington and Co., Boston, as an apprentice, and was given intensive training due to the manpower shortage. I learned that the fundamentals of accounting are quite simple, and it is only in their application and implementation that problems arise. These are basically of an engineering nature. Since business operates under law, there are also legal problems, which are best left to expert counsel. I was soon out in the field, and as I developed, my duties involved installation of financial controls, financial surveys for long range planning, and internal reorganization, including selection and training of key personnel. Many of these field assignments were of long duration.

"In the meantime, I had married Gertrude E. Morley of Rocky River, Ohio, and we have recently celebrated our golden

anniversary in Wellesley, Mass., where we have lived since 1923. Wishing to settle down, I accepted a position with Walworth Company as Comptroller of their Boston Works. Here I developed a new and modern financial control for this very old concern.

"Later, I accepted an opportunity to become Comptroller and Assistant Treasurer of the American Hide and Leather Co., Boston, where I served for 18 years. This old company had suffered both from inept and dishonest management, and was in a highly precarious position. Fortunately, the reorganization was effective. I then became President of the Orange Food Products Co., of Boston. Previously, as a Director, I had helped, both financially and operationally, in its reorganization. Results were good and we doubled our net worth in four years. However, retirement seemed attractive, and I resigned. I soon found that I needed work to be happy. I accepted an offer to assist with price controls and soon was with the Renegotiation Board. Later, I represented Mathison Chemical Co., for whom Stone and Webster and E. P. Badger were building a thirty million dollar petrochemical plant in Kentucky. I acted primarily as mediator between the northern and southern interests and must have been successful, as the plant was finally completed and became a satisfactory venture. Now I was ready to retire permanently, but in 1955 was asked to become controller of the prestigious Algonquin Club of Boston. Here I am still employed and have enjoyed the association greatly. So you see I still need my alarm clock.

"As regards outside activities, I served in 1938 as Chairman of an Industry Committee which secured the passage by Congress of the Last-in, First-out (life) amendment to the Federal Tax Code. I was a charter member of the National Assn. of Cost Accountants and with others, developed improved corporate accounting and established its usefulness. Locally, I was a member and chairman of several financial planning committees and it was pleasing to know that our efforts helped Wellesley to emerge from its post-war reconstruction problems as one of the few Massachusetts communities maintaining its AAA financial rating. I also served as chairman of both the town building and construction committees; the latter finally was successful in building a modern junior high school. May I close this long story on a musical note by saying that with all the 'Guys and Dolls' it has been my privilege to know, including my fellow classmates, their wonderful wives, my own 'Fair Lady,' many 'Enchanted Evenings,' and 'A Little Bit of Luck,' I have been 'A Most Happy Fella.' "

We have a note from **John Raymond**, Course II, saying that he is in good health and still with Metcalf and Eddy, Engineers, Boston, with whom he has been associated for many years. He writes, "Same old story. Catch the 6:30 a.m. from Beverly to Boston four days

each week. Try to rest up weekends but don't quite make it. Plan to walk one way to the office in good weather; however, the grades get higher and the trip takes longer than formerly, so perhaps the two hundred yard stretch from the elevated station is now enough."

Arch Eicher is recuperating fairly well from his heart attack, according to his wife, Agnes, and they are hoping to be able to take a short trip to Florida this spring. Letters will be most welcome.

We are sorry to report the death of **Roy Glidden**, Course I, which occurred suddenly on August 20, 1969, at 80 years of age in Geneva, Ill., due to a coronary occlusion. Roy's history was published in the March 1969 issue, at which time he had partly recovered from three successive strokes which had greatly restricted his activities. He is survived by his widow, Helen, one son and two grandsons.

Dr. Pasquale F. Lombardi, Course II, died December 18 in Waterbury, Conn., after a brief illness. He took a special course with our Class and then transferred to Tufts Medical, from which he graduated in 1921. After several years of practice in Waterbury, he attended Zu Wien University in Vienna, specializing in gynecology and obstetrics. He was on the staffs of the Waterbury and St. Mary's Hospitals, and was attending physician for the Chase Metal Co. He is survived by his widow, one son and three grandchildren.

Cy Springall and Marjorie sent a letter with a glowing account of the development of their first grandchild, Bobby, who is now 17 months old. They spent last summer at their camp in Dexter, Maine, and also took a trip along the Maine coast. They are again spending the winter at Scottsdale, Ariz. and repeat their invitation for any classmates to visit them. The address is 325 W. Fourth St.

You will be glad to know that **Jay Pratt** has recovered sufficiently from his heart trouble that it was possible for him and Priscilla to fly to Acapulco, Mexico, where they have been enjoying their usual winter sojourn. Our best wishes for continued improvement, Jay!

After contacting **Albion Davis**, our Reunion Chairman, we regret to advise that plans for a get-together this year have been abandoned. We do, however, expect to celebrate our sixtieth anniversary in 1972, probably on Cape Cod, so make your plans to attend well in advance.—**Ray E. Wilson**, Secretary, 304 Park Ave., Swarthmore, Pa. 19081; **Jay H. Pratt**, Assistant Secretary, 937 Fair Oaks Ave., Oak Park, Ill. 60302

13

When you boys and gals read these notes, spring will have arrived. Most of the annual town meetings will be over. We

taxpayers will be assessed for increased up-dated education, services, environment, and pollution by air, land or water.

Our classmate, **George R. Wallace, Jr.**, is still "Mr. Fitchburg" (Mass.). Several of our friends heard George over the radio when he was honored at the dedication of the "George R. Wallace, Jr. Civic Center." He entertained the participants, and they enjoyed George's wit and musical talents.

We are indebted to the Alumni Fund Committee for forwarding the following messages to your Secretary: From **Lloyd A. Hechinger**, word that he retired from Boston Latin School as science teacher in 1959 and retired as chemistry teacher from a junior college, June 1969. . . . From **E. Dana Pratt**, "If I am blessed with continued health and that of my family so as to complete a successful Oriental trip with Merle to assist me, then would I have something of interest and concern to report on education advance." . . . **Kenneth Hamilton** writes: "Here is the two bucks for class dues. Am still going strong and will write you a history some day. Hope you are OK. If you can 'eat, sleep, and keep open-minded', you can get along OK."

Thank you, **Warren Glancy**, for your letter regarding the death of Dr. Walter Whitehead. We quote, "Did you happen to see the account of the death of Walter Whitehead. It was in the *Herald* some time ago. The article said he was an emeritus or retired professor at M.I.T. I had lost track of him. It did not seem to be included among deaths of alumni in the last Review."

It is our sad duty to record the bad news as well as the joyful news. A letter was received from **Alexander Morrison's** daughter Althea, and we quote: "It is with profound regret that I write to you to inform you that my Father, Alexander Morrison, passed away very suddenly on December 31, 1969. It was a great shock to all of us, my Mother, my brother, Lincoln, and myself. Dad's years at Tech prepared him well for his long career with the American Woolen Company. On retiring in 1955, he was Director of Research and Development Division of the Company. Although not an active member of the Class or Alumni Association, Dad had high esteem for his alma mater. If there are any other committees or departments at M.I.T. who should be notified of this, I trust you will so advise them as I am unfamiliar with such procedures at M.I.T."

Also, we wish to thank **Azel W. Mack**, Secretary of the Class of 1915, for sending a clipping from the *Journal of the American Association of Textile Chemists and Colorists* which adds: "Mr. Morrison was a charter member of AATCC; he served as the association's second secretary from 1929-31 and was vice president from 1932-34."

Further, we were advised by the Alumni Association that our good friend and



William W. Brewster, Class of 1870 and Benjamin B. Brewster, '72—note the choice of hair styles.

classmate, **Samuel E. Rogers** had passed away on January 5, 1970. Sam and his nice wife, Margaret, attended several reunions, most recently the 50th at Oyster Harbors. A card of sympathy was sent to the families of both Alex and Sam.

The trials and tribulations still exist at the Institute, caused by a very small minority. We should be very proud and thankful for the outstanding manner in which our President Johnson, his various committees, composed of alumni, officials, loyal faculty and majority of students have conducted these matters.

The Brewster family based in Plymouth, Mass., has honored M.I.T. with four generations securing their education at the Institute. Mr. William W. Brewster was a member of the Class of 1870, M.I.T. **Ellis W. Brewster** is a member of our Class. William S. Brewster is a member of the Class of 1939, M.I.T. Spencer H. Brewster is a member of class 1943 M.I.T. Benjamin B. Brewster is a member of the Class of 1947, M.I.T. Now, Benjamin B. Brewster, Jr. is a student in the Class of 1972, M.I.T. This Brewster family has evidently established a record, by supplying truly loyal support to M.I.T. through four generations. Congratulations to you Bill and your charming wife Ellen.

Will we see you at the Homecoming Day, Monday, June 15, 1970? Change of address: **Edgar H. Weil**, 23811 Chagrin Blvd., Cleveland, Ohio, 44122. Until Next Month.—**George Philip Capen**, Secretary and Treasurer, 60 Everett St., Canton, Mass. 02021

14

Leon R. Abbott died on January 15, 1969, at his home in Whittier, Calif. For some years after graduation he was engaged in the business of orange growing. Later he became city engineer in the town of Whittier. We have not had any contacts in recent years with Leon, although in earlier days there seemed to be a certain bond between us, possibly because of the fact that we were both in Course VI and perhaps even because we were close together in the alphabetical listing.

Philip Covitt died last June 2, at his home in Bridgeport, Conn. (104 Griffin Ave.). After a few years in business in New York following graduation he be-

came assistant chemist at the Brooklyn Navy Yard. In 1934 he returned to Bridgeport where for some years he functioned as a CPA.

Ralph D. Weyerbacher, Commander U.S.N., finished his education as a naval architect with our Class. In 1918 he became Assistant Naval Constructor at the Navy Yard in Philadelphia with the rank of Lieutenant. In 1935 he joined the Bureau of Aeronautics in Washington becoming Commander in 1938. In 1942 he became associated with the Cramp Shipbuilding Company in Philadelphia; also later the East Coast Shipyards, Inc. in Boonville, Indiana.

Here are a few brief notes from other classmates including one from **Elmer Dawson** which we were especially glad to get. "I have pretty well survived the misery that caused me to miss the reunion. I greatly enjoyed the fine account in the *Review*. Congratulations to all hands for a superb job. E.E.D., Jr." . . . **Fred Karns** tells of his trip. "Margaret and I made, at last, a grand tour of Europe this fall. We sailed from New York on the S.S. *France* to Southampton, England. We travelled through England, Holland, Belgium, West Germany, Austria, Italy, Switzerland and France. Returned via TWA." This makes us not a little envious.

This note from **Alden Waitt** may be a good conclusion. "Here's an additional \$50.00 for M.I.T. in appreciation of the recent stronger stand against protesters. Don't temporize with dissidents who get pushy."—**Herman A. Affel**, Secretary, Rome, Maine. Mail: RFD2, Oakland, Maine 04963

15

Hello, all classmates! Our big thing for this column is the final on our 55th reunion. Friday, June 12 from 12 noon to 2 p.m., we'll meet in Room 7-102 at M.I.T. Enter at 77 Massachusetts Ave. and walk straight ahead. Wally Pike's committee will furnish the necessary transportation. At 2 p.m. we leave for Coonamessett Inn, Falmouth, Mass. where your room reservations will be set up. Just register at the desk. Saturday will be simply a day visiting together. There's golf near-by. The reunion class banquet will be at Coonamessett Saturday night with a welcome for Mary Plummer Rice, coming all the way from Frankfurt, Germany. Good (old) Mary!

Sunday noon at Poppanessett we'll have a real New England shore dinner. The bar opens at 12 noon. The reunion picture will be taken there at 1 o'clock and will be sent free to everyone attending. Even if you can't attend the entire reunion, come on down Sunday for the picture and shore dinner. We return to Boston Sunday afternoon. The Alumni Association is selling tickets at \$6. each for reserved seats for Boston Pops Concert at Symphony Hall, Boston on Sunday night at 8 o'clock. Monday morning will

1915

55th Reunion
June 12-14
Coonamessett Inn
Falmouth, Massachusetts

Annual Class Cocktail Party
and Dinner
June 15 at 4:00 p.m.
M.I.T. Faculty Club

Azel W. Mack, Chairman
100 Memorial Drive
Cambridge, Mass. 02139

be registration day at M.I.T. to get your badge and tickets. There will be a lunch but *no alumni dinner*, so why don't you plan to come to the class cocktail party with your ladies and guests (all FREE) at 4 p.m. at M.I.T. Faculty Club and then stay at the Club for the class dinner at 6:30 at \$7.50 each. After dinner, you're all invited to Bill Smith's 19-C apartment at 10 Emerson Place, Boston. Transportation will be furnished to Bill's. What could be sweeter? This may be our last reunion. Hotels convenient to M.I.T. will be listed on the reunion notice which you should receive about May 1. We must have your signed reservation cards back here by May 20. How about it—help us out—by returning the cards promptly.

In a discussion of "The Engineer's Responsibility to Society," recently published by the American Society of Mechanical Engineers, **Phil Alger** stated: "It is significant that more and more engineers are being called to leading positions in corporations—it has been said that by 1975 half of all the appointments made to head American corporations will be men with an engineering education. It seems to me that these developments are just what should be expected. For the engineer must be a specialist and, therefore, in large undertakings, must be a member of a team. He must be trusted and must trust the other team members, if the team is to succeed. The very fact that the engineer is educated on narrow lines forces him to learn how to cooperate; that is to say, he must have good ethics if he is to succeed. Therefore, rather than trying to educate the engineer in the social sciences, we had better let him be a technical expert and just do what we can to foster his good ethics. Good ethics consists in weighing fairly the needs of all those who may be affected by any action and also weighing the distant as well as the immediate effects."

Good **Jerry Coldwell** wrote: "Just a note to congratulate you on the Bronze Beaver award as noted in the recent issue of the *Technology Review*. You certainly earned it and I'm sure you are proud of it. May

you enjoy it for a long time." Thank you very much, Jerry, for your kind and thoughtful letter. I certainly do appreciate your sentiments.

Ray Gladding, Bloomington, Calif., sends best regards and says he is about to retire at age 80 in January. Nice going, Ray. . . . **Larry Landers**, from Hollywood, Fla., writes: "We are having a real rest but the weather can be much improved. The temperature has been down in the 30's. However, we can't complain after 3 weeks in the 60's; though the last ten days have not been so good, I'm sure the weather will be good again." At those famous and fabulous Florida prices that doesn't sound too hot.

Stan Osborn, West Hartford, Conn., says he is still busy on the Public Health Committee of the Connecticut State Medical Society and the Public Health and Industrial Health Committee of the Hartford County Medical Association. That leaves him little time to wet nurse his 12 grandchildren. Quite a guy is Stan.

The sympathy of our Class goes to **Frank Murphy** in Boston, whose wife died December 3.

With his annual Alumni Fund contribution, **Bill Smith** repeats: "Azel knows too much about me already." Maybe I should tell some of it. A great guy, Bill.

The January 15 *Peterborough* (N.H.) *Transcript* carried a long story on **Pop Wood's** report as Director of Peterborough's Civil Defense. In fact Pop said, "With the increase in upgrading of Civil Defense requirements over the nation in order to prepare its functional duties to meet any natural or other disaster with the best of local capabilities at its disposal, your organization—consisting of 41 dedicated personnel—has been active and busy. In compliance with the State of New Hampshire Emergency Plan and Local Emergency Plan, all Unit Leaders—to wit, Warning, Communications, Welfare, Shelter, Medical, Radiological, Rescue, Transportation, Fire, Police, Supply and Administration—have prepared their respective units for any emergency. We have answered, and done as directed by Warning, three 'checkerboard' alerts, and phoned out to 12 towns surrounding Peterborough." This is certainly a commendable public-spirited interest for Pop to have.

We regret to report that **Albert V. DeBeech** died August 24, 1969 in St. Petersburg, Florida.

Remember the reunion. You've had your final notice. We must have your signed card for reservations *at once*.—**Azel W. Mack**, Secretary, 100 Memorial Dr., Cambridge, Mass. 02142

16

Now, just a few weeks before the next class reunion at the same place out on Cape Cod, we have this little message

from our ever-going president, **Ralph Fletcher**: "In two months many of us will be together again enjoying our 54th reunion, June 12-13-14. As indicated in an earlier column, we plan to address ourselves at our business meeting to some of the controversies which presently are diminishing the Institute. We sincerely hope that you will attend. If you can't be present and want to contribute to this discussion, send us your thoughts to be received no later than June 12, c/o Chatham Bars Inn, Chatham, Mass." In the meantime, let us see what we can report in the way of class news and bits of philosophy.

Although it's a little late, your secretaries wish to acknowledge the many lovely Christmas cards and New Year cards received this year. Outstanding as usual were the original cards of **Bill Drummey**, the **Irv McDaniels** and the **Izzy Richmonds**. We'll see if it is possible to have a reunion exhibit of their cards over the past 10 years or so. With the cards came a number of little messages. Notably we had friendly Christmas greetings from Louise (Mrs. Steve) Berke, Ruth (Mrs. Leonard) Best, Jessie (Mrs. Steve) Brophy, Allie (Mrs. Ted) Jewett and Fran (Mrs. Steve) Whitney. The **Charlie Lawrances** and the **John Gores** mentioned especially their looking forward to the 54th in June. The **John Fairfields** tell of digging out from 13 inches of snow which meant they wouldn't be able to visit grandsons in Pearl River, N.Y., and thus a Christmas this year "without small fry." Then: "A score of evening grossbeaks, five cock pheasants and four hens, and the usual others make our breakfasting colorful." And from Blue-mont, Va. (see your atlas as we did, say 35-40 miles westerly from Washington, D.C.), the **Jim McClures** suggested we "good people" stop by and visit them "on the Mountain." "At least," says Jim, "we are always here because our guards and rulers, one ancient cat and one middle-aged cat, won't let us leave! Do come." Helen and **Bill Leach** in Austin, Texas, were apparently appreciating the lack of snow and ice and deep freeze of our near-New England area. And a Christmas message came from Bill and Millie Cann (Harvard and Pacific Palisades, Calif.) who participated 50/50 in our 41st reunion banquet at Chatham Bars Inn (1957) when the Harvard dinner was "stag," the message; "It's good to see the Class of '16 still going strong."

In one of his letters, **Vert Young** says he had been somewhat behind in his reading as a result of preoccupation with cleaning up after Hurricane Camille and the tax problems involved. "My house site and tree farm suffered extensive damage. I have already spent over \$4000 in labor and \$1500 in other expenses cleaning up debris and have gotten slightly over \$2000 in salvage in sawlogs and pulpwood. The market on sawlogs has dropped to less than half its pre-hurricane level. This week I had consulting foresters come in and appraise the damage both to the house site and to the tree farm to determine the casualty loss

involved."

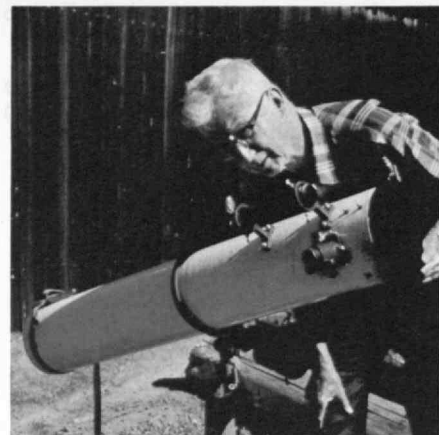
From Virginia, specifically from Virginia Beach, comes a word or two from **Clint Carpenter** in a complimentary vein, about the photograph of the "young men and their wives" at the 53rd reunion last year—sorry he wasn't there. Says Clint: "This cold weather throughout the country has not passed us by entirely. A couple of weeks ago Phyllis and I drove to Pittsburgh for a wedding and upon returning home a few days later found we had 10 degree weather for a couple of days and snow as well."

On the same subject, we have a Yes and a No from Delray Beach, Fla., where Gyps and **Cy Guething** told of missing the month-long deep freeze of their home in Birmingham, Mich. On January 2, Cy said it was nearly perfect weather. But by January 9 they were having 30 degree weather and he noted that while they were OK and in the pink, that was the first day he had been "chicken" about taking his daily swim or two. In the water it was fine; coming out was like hitting Arctic blasts. Cy spoke of a current telephone conversation with **Jap Carr** in Palm Beach, that Hildegard was recuperating well from a hospital visit, and that the doctors had just given Jap an OK for a light 10 minute tennis workout starting the second week in January.

To the West

Heading west, we first hear from **Charlie Cellarius** who asks for the dates of the reunion in June—something he needs for planning his summer. Let's post odds of two-to-one you'll make it, Charlie! . . . In St. Louis, **Berthoud Boulton** gives what all will agree is a pretty shrewd reason for giving up his formal college teaching last fall: "feeling it was better to quit while I was being appreciated." However, starting with the spring semester he will be a volunteer tutor in math for some of the 150 students at the college in "Project Forward." This requires a year's remedial work before undertaking regular college courses. He is past his 10th year as a Red Cross volunteer in which he does the cutting out of wooden parts for dozens of toys. The veterans at the government hospital then assemble and paint them. He says: "My eldest grandchild married last year and now is finishing work for her degree in June. My next grandchild is a junior at Dartmouth and a ski enthusiast. My only son is taking his final exams this spring for his doctorate in music." Berthoud sends his best of good wishes and is looking forward "to our 55th reunion and again wearing my handsome red jacket." We can't help adding editorially that his little old red jacket would look mighty good at the 54th this June!

Now on to the west coast and we have Kay and **Irv McDaniel** in their new home in Laguna Hills, right in the same general complex where Emerald and **Ken Sully** have been located for some time. Irv's letters indicate his concern for the way things are going here and there on cam-



Harold Mills, '16, and telescope built with his own homemade six-inch reflector—tested in New Jersey, Arizona and California.

pus and elsewhere but he is pleased with his new home. There Kay and he have started a new garden with new patented roses and hibiscus and all. He says: "Everything seems to be most convenient here and as usual the days are too short."

Next we hear from **Robert Kallejian** of Whittier. He had a difficult year last year with hospital visits and all, but as of the year's end he was optimistic about good recovery in the year ahead. Says they had visited their daughter and family in Knoxville, Ky., and simply fell in love with it there, where three grandchildren are in school. Their other daughter lives in Whittier. Two grandsons graduated from U.S.C. last June and the 3rd is now in Stanford. Bob says that with his inactivity last year he had not seen many important people except President Nixon whose boyhood home is only a half mile away. "We see and talk to the Nixon family often." Bob's bit of philosophy: "Have a good time while you are young. Don't work after you are 60. Otherwise you may not be able to enjoy your leisure and your money."

Some Notes on Travel

Back in January, 1969, **Victor Dunbar**, now of Sackville, N.B., Canada, started an unusual three-month vacation trip with a world tour group of the American Association of Retired Persons and National Retired Teachers Association. The trip was made on the Holland American flagship, S.S. *Rotterdam*. Victor writes in part: "The *Rotterdam* is a magnificent ship, with all the facilities of a small city—even a theatre/auditorium seating 620 persons. Although the ship normally carries around 1400 passengers on its regular transatlantic runs, on tours only about half that number are taken. However, the ship's staff remains the same; approximately 1,500. . . . On this voyage the *Rotterdam* stopped at 21 ports and covered approximately 31,000 miles. At each port one or more tours from one to five days (by taxi, bus, train or plane) added at least 2,500 miles making a total of over 33,500 miles. One might question whether such a tour,

covering so many places and allowing so comparatively little time to see each place was really worth while. My own answer would be: it certainly was. It was something like a kaleidoscope, involving hundreds of things of beauty or interest, and it gave us a perspective that left us with a clearer idea of what we would want to see in more detail when and if we should visit these places again." He gives a number of interesting comments on his visits to Rio de Janeiro, Capetown, and cities in India and Japan.

Last month, we also mentioned the **Merrick Monroes'** two month cruise to many ports in the Mediterranean. We asked him for a bit more information that might be helpful to the Mr. and Mrs. Venerables of the Class of 1916 and neighboring classes. Here is his interesting summary: "Ours was a freighter trip from October 4 to December 6; Concordia Line Norwegian ship, excellent food, accommodations, associates, etc. These ships take a maximum of 12 people, for more than that requires a doctor aboard. About all that is done is eat, snooze, shop a bit and rest. One gets an idea of the enormous amount of international, transoceanic traffic and goods, how it is handled, etc. These are no lah-de-dah cruises—no dressing for dinner, no big parties and the like, but to me, most educational and interesting. Miriam did not cook, make beds, sweep nor nothin'—all she had to do was simple washing of clothing, usually in the wash basin in the bath. The docks are usually a taxi ride from town. Then, from American Express or equivalent, one gets local coinage, finds out where to shop, lunch, etc. However, in all these countries, all stores close about noon, and do not open sometimes until 4:00 p.m. This is known as 'siesta' time. The result is that one shops, the girls at least, until about noon, then, having paid for dinner aboard ship, back to the ship. This cramps the female shopping trips especially when the ship may not be in port more than a couple of days. However, it was relaxing, educational and comfortable, but it is not for young people who are not as yet at the point of being satisfied to eat, sleep and loaf."

In an earlier note, Merrick added: "You start taking anti-seasick pills—Dramamine, Bonamine, etc., not prescription drugs—just as soon as the ship casts off her last line from the dock. Some people need only one or two for the whole trip; others, every day. I took maybe four, and on the Atlantic only, as the Mediterranean was relatively smooth."

From Here and There

Dick Berger of Bridgeport, Conn., continues active as head of "Cancer Prevention," a non-profit, tax exempt organization for research and publicity on probable causes of cancer. Today he is seeing the results of his lonely work since way back in the 1930s, with current wide support for his thesis that smoking is one of the basic causes of cancer. He hopes soon to write a book

telling about what he regards as interesting experiences with Thomas A. Edison, in the Navy, in the Marine Corps and during his work on cancer prevention. We'll look forward to receiving a complimentary reunion copy when it is published.

As we write (late January), we have word that **Hope and Theron Curtis** plan to get down to Clearwater, Fla. for three weeks in March at their old standby, the Clearwater Beach Hotel. Theron says they presume **Dolly and Peb Stone** will be hieing themselves to their favorite island in the Caribbean (Young Island off St. Vincent's) for a month or so—'tis true, as your secretary has now determined.

From three sources—Don Webster, Dave Patten and Nat Warshaw—we have received a page clipping from the January 19 Boston *Herald Traveler*, and whose picture do you think we see with an article titled "They Ease Ordeal of Fire"? Well, here's the caption of the picture: "Volunteer and Patient at Shriners Burns Institute are Col. **William W. Drummey**, 76, and Joey Thomas, 7." A second picture carries the caption: "Fire Victims at Shriners Burns Institute receive classroom instruction from Miss Emilie Norris. At the blackboard with her is seven-year-old Joey Thomas."

Excerpts from the article read: "Joey's right arm was in a sling tucked inside his blue shirt, and he was talking to **William W. Drummey**, a retired Army colonel, one of the volunteer workers at the hospital, who spends three afternoons a week there. . . . Miss Norris, 25, lives in Cambridge and is one of 68 Boston public school teachers in the department for the instruction of physically handicapped children. They go into hospitals and into homes where children are recovering from injuries or illnesses that keep them away from their school desks for a long time. The Institute, a 30-bed hospital, is part of the Shriners Hospitals for Crippled Children. There are other Shriners Burns Institutes in Galveston, Texas and in Cincinnati."

Ted Parsons, in a bit of history, tells of retirement in 1960, subsequent travel while living in Marblehead, and then their move to Pennsylvania: "About four years ago our children (daughter, husband and two grands) felt that we needed a bit of looking-after, so we moved to Phoenixville, Pa., the next town west of Valley Forge, where they live, and have enjoyed the area, the people and the proximity to our family to the utmost extent. Across the street is the Meadowbrook Golf Course, so that we can watch the efforts of the players, some of whom are worse than I used to be." He mentions seeing **Ralph Newhall**, '17, on their annual or semi-annual trips to the White Mountains.

Going back to our winter weather in early January, **Lee Jones** writes from Elma, N.Y., "Fortunately we have missed the big snows, but 12 inches in the first four days of this month is not encouraging. Some 200 feet of 20- to 30-year-old

blacktop driveway, and a 25-year-old Toro snow blower have me almost convinced that I need one of the new riding style models. (The grandchildren live 30 minutes away across country so they are no help). The bright spot is the red blazer we got at our 50th reunion. I occasionally go social and wear it, and it never fails to produce a number of very complimentary comments!"

We have a bit of helpfulness from **Bob Diemer** of Buffalo who still feels that "the best philosophy is to be an optimist, to think that perhaps things won't turn out as badly as they might," with his definition of an optimist, "a blind man in a dark room looking for a black cat that isn't there!" Of his undergraduate years at M.I.T., Bob's comment is: "'em were the days." As we look around at campuses today, we guess that's pretty much the way we all feel.

From Huntington Wood, Mich., **Tred Hine** writes that he is still working as Staff Architect for the Detroit Institute of Arts. "This has been a very extensive program of enlargement and alterations. I expect it will take a year and a half more to complete. I am 78 years old and as busy as anybody can be." . . . Another active '16er, **Barney Gordon**, tells of six grandsons, one in Harvard majoring in micro-biology and five in prep schools—two in Washington, D.C. and three in San Juan, Puerto Rico. He writes: "My eldest son is a psychoanalyst in Washington, where he did three years of research in the Mental Health Institute at the National Health Institute of Bethesda, Md., and then continued to live and practice in the environs of the Institute. He married Anita, a graduate of Mount Holyoke, who also studied law at Yale Law School. They have three sons and also gave us a very pretty four-year-old granddaughter who is evidently her old grandfather's darling. My youngest son is associated with me in business and runs our plant in Cayey, Puerto Rico. He has been there 12 years and his family is bilingual. His wife, Mona, who is a graduate of Wellesley, has been president of the League of Women Voters in Puerto Rico and she can address an audience in either Spanish or English. This gives me an opportunity to spend some time there during the winter season. In late September, I had a 'special' birthday. My children and grandchildren all came to our house in Chestnut Hill to celebrate this happy occasion. It was so wonderful to have everyone around the piano singing old-time songs and including some of the M.I.T. songs at the top of their voices." There followed, best wishes to all of 1916!

And speaking of grandchildren, **Paul Duff** says No. 33, Eric, has just arrived, and Frances' bracelet, with a new trinket added for each arrival, "is getting too heavy," for she is "crewelling like mad." Frances' and Paul's baby, Brendan, had "just been made 1st Lieutenant of Marines while in Vietnam." And their No. 2 son's daughter was New England Champion with her horse Blackberry

Brandy—she had more than 30 ribbons and trophies this past year. Our good Duffs, with their 10 children and the above-mentioned number of grandchildren surely have the potential for building up some records that will be hard to beat.

Counseling with SCORE

Mark Aronson of Miami Beach, in his semi-retired status, is a volunteer counselor with SCORE (Service Corps of Retired Executives), which is an affiliate of the Small Business Administration. He says any small-businessman who employs 25 persons or less can apply to the Small Business Administration for assistance in handling his problems, and a counselor experienced in the area of the problem is assigned to the case. There are, he says, presently more than 3,000 volunteer counselors in over 200 chapters in the United States—retired analysts, retailers, bankers, lawyers, economists, engineers, accountants, plant managers, wholesalers, public relations and advertising specialists, etc. "SCORE is the brain-child of a former head of the S.B.A. in 1964. In the previous five years, small businesses accounted for 91 per cent of all business failures. In nine out of ten failures, bad management was the main cause. The S.B.A. had a sizable financial stake because it lends money to small companies for equipment, expansion and working capital. If loan beneficiaries fail, the S.B.A. (and the taxpayer) loses with them. Mr. Foley, the head of S.B.A., decided to tap the increasing ranks of high-caliber retirees. Pilot operations were set up in Washington and Boston and were so successful, SCORE was launched full-scale from all 68 S.B.A. offices. Hundreds of retired businessmen promptly offered their services and owners of unsteady firms were even more responsive." Mark says it is impossible to pinpoint in dollars just how successful SCORE has been so far, but that there is Dun and Bradstreet evidence that in 1965, a year after SCORE began, small business failures declined considerably. Too, SCORE hopes to expand its membership to over 5,000 counselors.

Again we have the gentle reminder that the 54th reunion is only two months away—June 12, 13, 14 at truly charming Chatham Bars Inn, Chatham, Mass., far out on the Cape. Come and join the group—restful atmosphere, comfortable quarters, delicious food, the ultimate in old-fashioned New England clambakes on the shore, good golf and wonderful company for our annual get-together. And please continue to keep in touch, write a little but write often, and let us have a little today-needed philosophy for the better things to come.—**Harold F. Dodge**, Secretary, 96 Briarcliff Rd., Mountain Lakes, N.J. 07046; **Leonard Stone**, Assistant Secretary, 34-16 85th St., Jackson Heights, N.Y. 11372

17

The following letter came to Sue and Al Lunn and with Vi Proctor's permission they are sharing it with the Class. "Dear

Sue and Al, I do want to thank you for your kind and comforting letter. It was a source of strength to me and one of the first received.

"Knowing that there were classmates at the Church service I asked the pastor to read your letter from the pulpit. Dix's classmates and M.I.T. meant a great deal to him, and there were few things he enjoyed more than when he was 'with the boys.' Well, a grand guy has gone home, and his patience and understanding is going to leave a little vacant spot in a great many hearts. Having had all my love in one basket, and having worked and played side by side for nearly 45 years, there is a vast emptiness.

"I also want to thank the Class for the beautiful floral piece. The ribbon on same reading, 'Your classmates of 1917, M.I.T.' I have saved as a memento of many reunions together.

"I have received ever so many heartfelt letters from the class which have been greatly appreciated, and I have wanted to acknowledge each at an early date. However they have been the hardest for me to write, knowing Dix's feelings for each of you. It ever surprises me the vast contacts Dix had with people in all walks of life, strangers to me, expressing their joy in having known him.

"I was sorry Al to learn of your hospitalization, and trust that is all of the past now.

"Let me take this opportunity to wish you and Sue, and all Seventeeners, the very best in 1970. Fondly, Vi."

Next June 14 and 15 are the dates for the M.I.T. Homecoming or what we used to call Alumni Day. Symphony Hall is booked for Sunday night June 14th for the Boston Pops with Arthur Fiedler. There are only 1,186 table seats on the main floor. So mark your calendar and when the registration notices arrive, get your reservation in at once.

Only now does it come to our attention that **Don Tarpley** was married last year. He sold his place in Darien and in his new home in New Canaan has a drafting room so if his arm is twisted hard enough he might get to work.

No damage was done to the large Rodgers Building mural that the class widows so generously gave as a memorial though it hangs in the reception room of President Howard Johnson's office. Artist and creator Nelson Chase stood ready to make any repairs but fortunately none are necessary.

Writing these notes in February to make April reading of reunion postcard memos as of last October will still give us news of several classmates. **Al Moody** is living a quiet life in Denver; the Admiral **Bill Sullivans** may now be all settled in their new home in LaJolla; **Carleton Adams** keeps working at what was "Fruit of the Loom" in Rhode Island; **Paul Woodward**

was off to Rome to spend the winter; **Howard Melvin** suggests a reunion in California for it is only five hours from Boston and New York; the **Walter Beadles** spent three weeks in the Greek Islands last May and most of the summer cruising in Maine; the **Dusty Wilsons** got to Europe, South America and Mexico during the year; **Noah Gokey** was sorry to miss the reunion, friends and not being able to collect his (Ray Maeder's) apples.

After three years in California Helen and **Jack Wood** bought a charming little house in San Diego. They write, "We are happy and love California even though we miss our beloved New England. We have about a third of an acre of land and the former owner had horticulture as a hobby, so we have specimens of about every kind of California tree, shrub and succulent—more than we can keep up with. Jack worked hard with the young people at the Yacht Club all summer, and continues to supervise their races on weekends and holidays during the winter. While there are many frustrating aspects to this, it does keep him in touch with yachting and yachting activities in San Diego and California, and the 100 youngsters in the program think the world would fall apart if Jack were not there to guide them. So do their parents. We just attended their Junior Awards dinner. Two hundred-twenty people were there, and three years ago there was nothing, they say. Quite a testimonial!"

The **Bill Dennens** find New Zealand very interesting with about all features found in the U.S.—glaciers, hot springs, high mountains, broad farm lands and millions of sheep.

Our Northfield reunion came at the wrong time for Betty and **Ray Ramsey** for they were sailing from Montreal on the Russian liner *Alexander Pushkin* and it was a delightful 14-day sail. Ports of call were in France, England, Germany and Finland. After 12 days in Russia they took a 53-hour train ride through Rumania and Bulgaria to Istanbul where they stayed a week. Then, after 5 days in Athens they went by train to Belgrade and made the Dalmation coast by private car. Next it was to Venice and Genoa and the S.S. *Michelangelo* to New York stopping at Cannes, Barcelona and Gibraltar.

It will not be any surprise to **Ed Raymond** to read that he got a 1917 blazer for his birthday in February. It seems that he and/or his wife Jessie saw some '17ers all resplendent in blazers and liked it. So good wife Jessie ordered one and "is sure it will be most becoming as Ed is still very handsome with snow white hair—but hair!" They are living in the home they built 21 years ago in Palos Verdes, California.

Dick Catlett writes, "For a number of years I have been retired from active control of our little company in Richmond, Va., but I am Chairman of the

Board and have a modest fee as consultant. My successors have done a grand job. I am lucky to have an office to go to for a few hours a day, saving my wife from the burden of keeping me busy."

More notes from the postcards: **Al Kenigsberg** is back from another European trip, this time to Spain, Portugal and Israel; **John Harper** hasn't retired yet from his oil business in Patterson, N.Y.; **Earl Lewis** keeps active in business but took time out for a vacation in Puerto Rico; **Al Pierce** is another one of the travelers, this time also to Europe; **Barney Dodge** wants to stay home a while after his tripping, lecturing and some skiing; **Rene Pouchain** also has been doing some traveling abroad.—**Stanley C. Dunning**, Secretary, 6 Jason St., Arlington, Mass. 02174

18

As I think back to the days of yore—meaning our undergraduate years at M.I.T.—it seems to me that particularly in our freshman, sophomore, and junior ones, the Class of 1918 enjoyed an esprit de corps second to none. Then the roof caved in, World War I arrived in April 1917, and within a few months most of us were involved in various capacities in the armed forces of our country. All the normal senior year activities, the prom, graduation, and other social functions which bring men closer and further cement college friendships, all these were cancelled as we were scattered in many parts of Europe and the United States.

I would be less than candid if I did not admit that our class spirit became in part a war casualty. Slowly, however, we began to put the shattered pieces together and a definite resurgence started to take place, reaching its peak at our 50th reunion almost two years ago. I felt the approximately 25 per cent of us who spent that weekend together recaptured and invigorated a spirit of loyalty to the Class and to M.I.T. rivalling that of any other alumni body. Further than that, those unable to attend manifested a togetherness with us who were at the reunion, in many ways.

One heart warming evidence of this resurgence of class spirit was a spontaneous and unsolicited effort by **Leonard Levine**. In early January, he sent letters to fifteen classmates to whom he felt close in 1914-1918, but from whom he had heard nothing since. Two had gone on to their great reward; two men sent replies which are recorded here in part. More will be heard from hopefully in due time.

Your secretary sent a partial report of his stewardship at the close of 1969 to all of you and once again it is my pleasure to include the comments as I receive them from you, in whole or in part. All this is grist to my mill—for I believe what you think is what should be

in our class notes. **Paul McGreenery** writes to Lennie Levine as follows:

"Dear Lennie: Indeed I do remember you. I recall you as a very fine young man and very friendly. It seems so long ago and everything seems to have changed since then. I heard somewhere that you were retired and teaching at a trade school and envied you as you were doing something interesting and useful.

"I can't understand why anyone would be the least bit interested in my dull past but I'll bring you up to date and you can edit it as you will. When I got out of the service in 1919 I went back to Tech and repeated my senior year. This was kind of dumb because when I got out there were no jobs around. I located a job in the engineering department of the United Drug but the depression of 1921 resulted in my being fired. I studied accounting and landed a place with the methods department of the Nashua Corporation at Nashua, N.H. The depression hit there after six months and again I got bounced. However I got a job in the warehouse of the same company the next day as a pilot. You know, pile it here and pile it there. After a few months I was placed back in the methods department in traffic and warehouse work. In 1928 I was transferred to their affiliate in Boston, Carter, Rice & Co. In 1935 I was made a director, and in 1937 treasurer.

"I was in charge of operations, accounting, real estate, warehousing, traffic, insurance, personnel, manufacturing, or everything except sales and merchandising. I took over warehouse planning and construction and travelled quite a bit. We had warehouses along the eastern seaboard from Washington, Philadelphia, New York, New Jersey, Hartford, Springfield, Worcester, Augusta and of course Boston, plus Pawtucket. We started a centralization plan like the food chains, running trucks at night from the main warehouse in Braintree to feed all the branches. We built new plants in Baltimore, New York, New Jersey, Pawtucket, Allentown, Springfield and other such spots. It was quite an experience and I was as busy as the proverbial bee.

"It's funny, but I never ran into any of our Class in my travels and was away so much that I did not have much chance to look up anyone. About the only ones I saw were Alex Magoun and Carl McLaughling in Chicago. I lived in Belmont for over 18 years and got involved in civic matters as everyone does. I was commander of the local legion post, Middlesex County Commander and was two years president of the local P.T.A.

"I was finally secretary of the corporation and retired in 1965. My family all got married so we sold our Belmont home and retired to a small place in Hanover. By the way we had three children, ten grandchildren and one great-grandchild. I spend all my time working around the



Willett F. Searles, '18

house and taking it easy. We are both in good health and enjoy life to the limit. The only time I see a Tech man is when he wants me to endow the Institute, but with all my progeny I feel that they need whatever help I can give more than Tech. I think I have gotten everything down to the basic simple life and for the time I have remaining I hope to keep it that way.

"I would like to see you and some of the other fellows but when and how and where? Perhaps the opportunity will turn up. Thanks for your interesting note and for remembering me. I sincerely hope we can get together some day. By the way you told me very little about yourself, or do you feel as I do about my so-called career, that it is not important. Best regards and take good care of yourself."

Lennie's too modest reply follows (one day we will fill in more details).

"Dear Paul: I enjoyed your letter very much, and I am sure that other classmates that knew you will also get a kick out of hearing about you in the class news. I am sending it to Max Seltzer who takes care of these letters in the alumni magazine for 1918.

"My record has the typical ups and downs—mostly downs—through the depression and ups in the last 20 to 25 years. I was retired by Uncle Sam at 70 from U.S. Natick Labs in Natick where I was doing N.E. research. After loafing a month, I took this teaching job in a Boston trade school—teaching mechanical drawing and machine design out of same book we had at M.I.T. during our freshman year (French & Vierck). . . . "It would be nice to see you again. May I suggest attending the Alumni Day at Cambridge next June. There is as you know, a table at the luncheon for each class, and I hope there will be a fair representation.

"Your letter underrates you. You still have the spark and humor you had in school."

Through the courtesy of Len Levine we have news of **Eaton Clogher** from North Haven, Conn. He reports he is in good

health. The smartest thing he did was to marry his wife; nothing he could write or has seen written can express his constant affection for her. There are three children and four grandchildren to keep the Cloghers busy and happy. The youngest daughter is an architect (M.I.T. 1960). Eaton has been in the heavy road construction business for many years—in addition he operates a ready mix concrete establishment—all of which keeps him on his toes every day.

Most of the replies to my year end report came from the far West. Here is the first one from **Bob Rowe** (as you probably now know from earlier class notes Monk Pierce is also resting with John Clease and the others). "Your Dear Classmate letter of December 20 invited reminiscent response. Mine is prompted also by your publication in *Tech Review* for December of an autobiography of Bill Wyer. I wondered where he had been and was glad to find out.

"In the summer of 1917, most of the students at the surveying camp at Gardner Lake, Maine were juniors (Class of 1919), but there were five seniors, all of them transfers who had graduated from other schools and entered MIT as juniors. Alphabetically, these were John Chase (U. Rochester), Bill Lohmeyer (VPI), Monk Pierce (Miami), Bob Rowe (Harvard) and Bill Wyer (Yale). After one month of regular assignments, Professor George Hosmer decided on some higher education for the five of us—experience in second-order geodetic surveying by triangulation with a 5-second Buff theodolite. He had us establish a fly camp about 5 miles away from the main camp—helped by two juniors (Myles Connors and Howard McClintic) as observers and axemen.

"The terrain was a densely forested irregular array of drumlin hills. The problem was to develop a network of 5-mile lines. Typically to see from hill to hill, the sight lines had to be at tree-top level. We did find a few high hills with clearings at the top. On another we found a cluster of seven white spruce, topped the central one 35 feet from the ground as a pedestal for the theodolite and the other six 30 feet from the ground as supports for an observer's platform.

"One considerable area baffled us for days—the highest hills boasted the tallest trees. The ultimate solution was a spire station—not to be occupied by the theodolite but located by intersection and used by resection. Bill, John and I undertook the reconnaissance to find the tallest tree on the highest hill, climb it, chop off its upper branches, and wrap

its denuded upper trunk with varicolored flagging. We each had climbed several 100-foot trees before we found the tallest. Being the runt of the three and able to climb higher with safety, I was 'elected' to flag the top. The task had been so arduous that we thought it fitting to reward ourselves by naming the spire triangulation station 'CRAW' from the initials of 'Chase, Rowe And Wyer.'

"This 'higher education' was priceless. George Hosmer was a perfect teacher—assigning problems requiring ingenuity, lauding our successes, helping with subtle hints when we failed, broadening our knowledge of nature generally and the forest in particular, and welding our diverse group into an effective working party. We admired him as a gentlemanly scholarly teacher and as an all-round outdoorsman—also, in retrospect, as a psychologist. For example, instead of forbidding smoking in the woods, he said simply, 'It's better not to smoke while surveying lest you turn your head quickly and your pipe disturb the theodolite. Not that I'm against tobacco; I chew myself.' The smokers among us left our pipes in camp and learned to chew! Again, when Howard's axe glanced off a tree and gashed his leg, George didn't baby him by evacuating him to the main camp infirmary; after checking our first-aid dressing he told Howard, 'You'd better be Camp Cook until your leg is healed enough for hiking.' Two days of cooking and camp chores effected a speedy recovery.

"Camaraderie developed in this fly-camp instruction was a pleasant part of our senior year at the Institute. Lohmeyer had graduated, but the other six were often arrayed together undertaking the herculean labors imposed by Professors Swain, Spofford, Breed et al. Then, with a war going on, we went off in all directions.

"But in 1919, Edythe and I were living in Washington, as lonesome newlyweds, and so were Bill and Katherine. We met often—including twice at the home of Myles with his parents. No evening was complete without some reminiscence of our fly-camp adventures. Next year Edythe and I moved to Salt Lake City, and who should show up from time to time but Bill and Katherine trying to find out how much the government owed the nearly bankrupt D&RG RR for depreciation of its property during war-time federal operation. Then in 1923 we moved on to San Diego, seeing no more of the Wyers, but often visiting with John who lived in nearby Riverside.

"Well, John Chase, Bill Lohmeyer and

Myles Connors are resting under their last benchmarks. I was disappointed not to see Monk Pierce and Bill Wyer at our 50th and the Wianno Club. Perhaps we will all make it to the 55th and rehash our fly-camp memories. Meanwhile, thanks to you, I know where Bill has been to these last 47 years."

This month we have a snapshot of **Wilett Searles** and a synopsis of his doings.

"Thank you for your communication of December 20th, forwarded to me at the above address from Santa Rosa, Calif. Two of us left M.I.T. for summer employment in West Virginia. I enjoyed the position to the extent that I decided to remain for the year. Later I enlisted and served with Naval Aviation in France for the duration of W.W.I., then resumed my former employment as Division Superintendent of Power and Mechanical Department in Virginia, West Virginia and Kentucky.

"Having been raised in the Pikes Peak area of Colorado, and married, we decided to go West in 1923. I entered the employment of the Holly Sugar Corp., and established residence in Sidney, Mont. After living in Montana for 40 years, we moved to a retirement area in Santa Rosa, Calif. Three years later, in the Spring of 1969, we sold our California home and moved back to Montana's dry climate, the 'Big Blue Sky Country.'

"One day while in Santa Rosa, I received a phone call from Omaha, Nebraska. The caller was soliciting money for M.I.T., I think some anniversary. I neglected to write down his name and address. A few weeks later the Telephone Company called, asking for the name of the party who called. I regretted that I had neglected to record it. Evidently that call had not been paid for. The motive of the Omaha caller was probably legitimate, but I cannot believe that any M.I.T. man intentionally would try to gyp the Telephone Company."

"I am 78 years old, and do not anticipate any further change of address will be necessary. There is an old story, that to obtain the first residence in a Montana cemetery, it was necessary to start a gun fight. Not being a gun man, I will probably last another 20 years or more, as Montana's dry climate is productive to long life. After living in Boston, the Southeast and in California, a person residing in Montana knows that he has found 'God's Country.'"

From **Edgar Goldstine** comes the following news. "I have been listening to the young moderates and radicals, including



MAX SELTZER, SCRIBE
60 Longwood Ave.
Brookline, Mass
02146

This decorative envelope expresses the enthusiasm of classmate John Abrams, '18, for his Class Secretary.

two sons working for their Ph.D.'s in philosophy and psychology, but have not heard too much of value. In 1917 I criticized some of the weaknesses in educational methods, my letter was published in the *Engineering News Record*, and much of that criticism and the recommendations made are still valid. I have no sympathy whatever for the destructive efforts and ideas of our radicals. They know how to destroy our society, but have neither the ability nor energy to improve it—and there are ample opportunities for improvement.

"After leaving school I was engaged in engineering design, a public utility evaluation for the purpose of obtaining a rate increase (they got it!), and in building construction as a superintendent for ten years. During the depression became a safety engineer for three years, followed for 35 years as a safety consultant. While I have worked with a number of industrial organizations, nearly all of my clients are engaged in construction.

"It has been my good fortune to attend four out of the five sessions of the World Congress on the Prevention of Occupational Accidents, held every three years in various cities in Europe. I missed the fifth two years ago due to paralysis of my legs from pressure on the spinal cord, possibly from a ruptured blood vessel. Following an extensive operation there was a complete recovery. In May my wife and I spent a month in Israel and Europe, seeing among other things the Acropolis in Athens which I had wanted to do for many years. I am in excellent health, and quite busy, although not as active as I was some years ago."

I received a very interesting report from **John Abrams**. He has added to his duties as secretary-treasurer of the Bishop Creek Water Association that of being president. As a result, he is to be congratulated because his pay was increased from \$25.00 to 80.00 per month—all of which permits him to pay his wife \$2.50 an hour to push the lawn power-motor or line the brook with 40 lb. fieldstones. His envelope address is a work of art. I enclose herewith his newsy letter from the high Sierras in Bishop, Calif.

"Hey, Max—You're sure a faithful soul! Surely the lowly peasants who sit on their posteriors and watch TV can respond with a few thousand words of deathless prose on their other activities. Aside from being the work horse—believe it or not, president-secretary-treasurer—overseeing this 100-year-old irrigation system traversing 650 home-places, I have other chores. These involve that modern watchword, environment, in this beautiful High Sierra Valley, land grabs by the privileged interests, sewerage, water supply, etc., as *people*, just people, come and leave their trash or stay and foul our Bishop Creek. I was going to write about the interesting fact that the brines of the deep geothermal steam wells near our Saltin Sea yield Av and Ag and Pt and detectable values of rare earth elements such as osmium, gadolinium, rhenium and lutitium. But that would take a dissertation on magnatic water from the realms of Pluto as background material. No time for that because I'm going to L.A. for a check-up on enlarged thyroid. I've heard from my old chums, Sam Chamberlain and Brick Dunham. I sure liked the firm restraint imposed upon the wild ones by our Howard J. Love, John."

Palmer Giles, Comfort, Texas, munches no words in his feelings about student demonstration. "Student demonstrations are going on all over the world. As an alumnus of M.I.T. I am ashamed that students broke the laws of our fair land, at M.I.T. Just remember we have always had violent children, people and students in every walk of life. The difference now is that we tolerate it. When I was a student at M.I.T. if any student or group of students started to interrupt classes or started to disobey the orders of the school, they would be immediately expelled, by force if necessary. In this way any students who did not appreciate the wonderful opportunities that our schools are offering them, would be immediately replaced by students from the long waiting list of students longing to enter M.I.T. Nothing has changed about the ten commandments since they were first given to us. Nothing has changed about good manners, good behavior, good character, good healthy and industrious

habits. We must remember that here in the United States, we have the best of many nations of the world, but we should not forget that we also have here the worst of all nations in the world. That is why we have laws. However laws are of no value unless they are enforced. We simply have to enforce the laws. To enforce the laws of our fair land, we simply have to have a high class of law enforcement officers. We should pay these officers such high wages that we would attract high class individuals. Then we should, simply have to back up these law enforcement officers. If any person, be he white, black, red, brown or yellow should ever draw a weapon or throw a rock at any law enforcement officer—he should be shot and killed on the spot. Our founding fathers did not put pistols and guns on law enforcement officers just for decorations. Witness the wonderful work that the F.B.I., The Royal Canadian Mounted Police, the Texas Rangers and the Mexican Rurales have done, simply because we back them up in everything that they do.

"Whether we like it or not, just think what would happen if the police in any city in the world would be overpowered or withdrawn, or eliminated for just one night. We do not have to go outside of the United States to see what did happen in some of our big cities. Fortunately at M.I.T. we have at least more than 99 per cent of the students there who are just as ashamed of what recently happened as 99 per cent or maybe 100 per cent of the Alumni."

Stuart Elliott sent me an interesting article concerning the "Daedaleus" which I am condensing for you. The Order of Daedaleus was organized in 1934 by a small group of World War I aviators, the men who fought the first great battles in the sky. As a major in the air force, Stuart was in Lafayette Escadrille force. The planes had a range of 2 hours and 20 minutes flying time with a top speed of 136 miles per hour.

They tangled with German Fokkers often at 18,000 feet altitude. He writes, "Both flights near St. Michael became a climbing watch seeking the advantage of the higher altitude prior to attack. The air was clean and cold, and the Spads flew wobbly as we reached 21,000 feet and well above the also struggling Fokkers. We dove and chased them 15 miles inside the enemy lines and almost to the ground where we had to give up our quarry due to heavy ground fire. The results were indeterminate, but that engagement must have created a record height for World War I fighters. Oxygen and parachutes had not been

developed, and the open cockpits lacked heat or 'comfort provisions.' "

Stuart participated in a great many thrill-filled air battles all of which should be in a book. The Daedaleus—the military flying fraternity—gave him and his many comrades the opportunity to relive those heroic days at their frequent conventions.

Here is **Alfred Grossman's** story. Upon graduation he was offered a job by the Guggenheim interests in South America at one hundred dollars a month in gold. He turned it down; instead he became a transit man in Quartermaster's Department of the Army until his discharge in May 1919. Then he joined the Phillips and Clark Stove Company of Geneva, N.Y., as junior engineer designing stoves and furnaces. In April 1920 he changed jobs so he could follow the mining profession in the engineering department of the Empire Steel and Iron Company, Mount Hope, New Jersey. The most interesting project for the group was to cut a tunnel about 1,000 feet long at depths of 1,100 feet. The mine was started from both ends and there was great satisfaction in the two sections meeting absolutely accurately.

While on vacation at home in March of 1921 Alfred accepted a position with the Highway Department of the Massachusetts Department of Public Works as inspector of highway and bridge construction. The work was interesting—particularly when he met a young lady while surveying a road in Hingham who with the chemistry of love became his wife after a whirlwind courtship. Soon after the marriage, his father-in-law and he started a rubberizing plant in Mattapan, Mass., under the name of Stedfast Rubber Company. They manufacture linings for women's shoes, electrical tapes, friction tapes, and other rubber products. They have several plants in Massachusetts and Granby, Quebec. The work gives him great satisfaction. There is no thought of retiring at present. Stella and he are fortunate that both their daughters, live close by and have given them four grandchildren to love.

I recently saw **Henry Berliner** in Washington. In an earlier issue of the *Review* you received a synopsis of what he has done. I was particularly impressed with the turn of events in our lifetime which made his services so valuable during the critical World War II years. When some unusually difficult problems arose, Classmate **Ted Wright** (War Production Board) called in Henry to solve them. He sold out of his company over 10 years ago; his ranch house in subur-

ban Washington is most charming. Henry and his wife were indeed cordial. Would that I could visit each one of you, and get the satisfying results of a face-to-face conversation.

Through the grapevine I have news of **Sam Barron**. His niece, Mrs. Rogers and I sat at the same table at a dinner meeting. I learned from her that Sam operated a coal mine in Pittston, Pa. for many years after graduation. He retired to move to Florida a few years ago. Some of you in Florida ought to get together occasionally.

Len Levine deserves a croix de guerre for writing to classmates whose paths have not crossed his for years. Watch for the results next month. . . . It was good to have my letter acknowledged by **Jack Poteat**. He reports Frank MacGregor, '07, (he gave M.I.T. a dormitory) and many other duPont men are neighbors. They like to talk about M.I.T. and its problems. In January, Tryon, N.C., was down to 2° Fahrenheit with snow, a rarity but beautiful. . . . **Harry Katz**, thanks to Len Levine's notes was in the Boston area around Thanksgiving. He has a difficult arthritic condition—but he gets around. Keep going, Harry!

Bob Collier has this recommendation, "Still believe in individual enterprise. Too many American youth aspiring to college education. M.I.T. should be 100 per cent post-graduate. Trade schools would best serve the average youth. Labor unions should be forced to measure up or be controlled. Keep working or stop breathing."

George Brewer files this report. "Since retirement in 1961, my wife and I have been seeing bits of the world. In 1962 it was Germany to visit a son, then to Switzerland and north to Scotland, following the new spring blossoms all the way. In 1966 it was the Mediterranean with stops in Africa and Europe. In 1967 it was South America via the Panama Canal and in 1968 we visited a daughter in Pasadena, Calif., then spent a couple of weeks in Hawaii."

Albert C. Walker writes, "Gave talks (2) on 'Serendipity,' [the gift of finding valuable or agreeable things not sought for] one before the New England Association of Chemistry Teachers (NEACT) at its annual meeting at Plymouth College, Plymouth, New Hampshire on August 24th, the other a repeat of this before the Science Department of the Eisenhower College, Seneca Falls, New York on October 7th. These both made big hits (I stole the show)."

A welcome note from **Ernest Bridgwater** follows: "Thanks for your good letter. I've been terribly negligent in not writing. My excuse used to be that I was too busy with local affairs, but since this arthritis in my knees has immobilized me I have no alibi. All I have to do is to observe that the organization changes at duPont are enabling the present management to do a better job than was done in my day.

"And nearly all the young people I know are more capable and more strongly motivated than their parents and grandparents. I see no generation gap, nor any lack of communication. Of course there are a few dissidents who want to tear down the society we have before they can agree on a replacement. Like some of the politicians of our generation who tear down the slum dwellings, but aren't ready or able to replace them with better communities!

"But these young protesters who cause so much trouble at M.I.T. and across the nation and the world are a very small minority. And when the 'great silent minority' gets ready to tax itself heavily enough to care, some of the shortcomings in our society that provide excuses for actions of that tiny minority of radicals, the young radicals will join the builders and desert the protesters.

"Our country is an infinitely better place to live than Europe was in 1770—and it's going to be many times better in 2070, despite the dissident minority and the selfish silent majority that is afraid of losing the preferred position they now have.

"Max, don't use up space in the '*Review*' to publish all this. Just record that I, for one, think there is not merely hope, but assurance of a better life for our successors. Keep up your good work, Max, and preserve your health, so that you and I both can see the victory ahead for Howard Johnson and all the forces of progress and decency."

I include a copy of a letter from **Herb Lerner** to President Howard Johnson.

Undoubtedly he has heard directly from President Johnson but for everyone's information the law breakers have been brought into court and their cases will be heard in the civil and criminal courts, the punishment will be handed down by the judges and juries. "Thanks for your communications of 18th January. I read all about this matter in the *New York Times* a few days ago and I am burning with indignation and disappointment that those hoodlums were not immediately evicted and thrown into jail as they

richly deserved.

"It is no wonder that so many people are having sober second thoughts about leaving any of their hard-earned dollars to educational institutions."

Now that Len Levine has broken the ice with a letter to classmates, why not follow his example and do likewise.—**Max Seltzer**, Secretary, 60 Longwood Ave., Brookline, Mass. 02146

19

George Bond sent in a note with a clipping about one of our classmates. George keeps busy with his various activities and travels quite a bit. He covered 7,400 miles last August to Colorado and Utah visiting the various national parks and has now been in 48 states and Canada. George's clipping from the *Philadelphia Bulletin* carried a story of **Harry Kuljian**. Harry furnished free designs for three churches, two in Philadelphia and one in Beirut, Lebanon, and carillons for four churches. Harry has also provided scholarships for many students in Lebanon, Pakistan and India. For his many deeds Vazkin I, Eastern Orthodox Patriarch of All Armenians, awarded him a gold diamond and ruby medal of St. Gregory the Illuminator.

Will Langille sent a note to the Class covering expenses for the 50th reunion. Your secretary urges you to send him cost of Red Blazer if you haven't as yet and contribution of approximately \$50.00 for expenses incurred including 50 year books, meals at McCormick Hall, class dinner at Chatham Bars Inn and printing and postage. Also if you can make commencement this year get a reservation at Chatham Bars Inn for June 12, 13, 14, the weekend before commencement.

A card was received from Allegra and **Karl Rodgers** from Spain. Karl has offered M.I.T. an E. Ambrose Welster painting as a class gift. Karl now uses a single golf club with an adjustable head for play in Spain.

Addresses sent in by the Alumni Association include: William R. Bennett, 22 Hillside Rd., Rutland, Vt. 05701; James A. Howe, 10418 El Capitan Circle, Sun City, Ariz. 85351; Arthur R. Ford, 212 Rodney Rd., Ridley Park, Pa. 19078; Ralph H. Gilbert, 238 E. 31st St., Brooklyn, N.Y. 11226; Richard S. Holmgren, Box 171, La Mesa, Calif. 92041.—**Eugene R. Smoley**, Secretary, 50 East Road, Delray Beach, Fla. 33444

20

As the great reunion rushes toward us with express train speed I can only repeat what has been told you by Ed Ryer's letter—namely that plans are now complete and that the success of this largest and grandest of all reunions is positively assured.

A warm New Year's letter from **George Des Marais** was written from his daughter's home in Ohio where George was enjoying the holidays with his four grandchildren. One of the four is a boy, a star student and athlete who George hopes will develop an interest in engineering. The boy's father is a supervisory engineer with Babcock and Wilcox. George mentions that a year ago he was spending the holidays with his son and family—they have two children—in Rutland, Vt. Except for a trip to California and Las Vegas, George says he has stuck close to his home in East Orange, N.J., where he has lived for forty years. He is reluctant to consider himself retired, although he pulled out of his patent counsel firm in New York City three years ago. He has kept his office at 250 Park Ave. but does an increasing amount of work at home. As previously reported, he lost his beloved wife, Louise, two years ago. A faithful and stalwart member of the Class, George is looking forward to the reunion. In recent years he has seen Marie and Phil Byrne, news of whom is reported below. "Their usual infectious joy was great to behold," says George. He has also glimpsed **Al Glassett**, "still going strong," and had a delightful visit with Florence and **Lee Thomas** as their guests at the New York Civic Center Opera.

A letter from **Phil Byrne** confirms George's apt description. Phil writes, "we continued our round-the-world jaunt after seeing you and Amy in Madrid. In 1967 we visited Holland, Norway, Sweden, Denmark and Ireland. In 1968 we took a Pullman tour to Yellowstone and the Canadian Rockies. This was travelling in a fast disappearing way. In 1969 we had a wonderful trip to Ireland, England, Scotland and Wales. At the moment we are scanning maps for more travel.

"We go to Maine every October to photograph the beautiful fall foliage. (Be sure to bring your pics to the reunion, Phil. I promise to outdo them with my 3D color slides of Vermont and New Hampshire.) While at Lake Kezar, Maine, we usually see the **Norrie Abbotts**, and while in San Francisco a few years ago we met our classmate, **Tsen Fu Wei**, whom I hadn't seen for 45 years when we worked as shipfitter's helpers in Squantum, Mass." Phil tried to persuade Tsen to come east for the reunion. We hope he proves successful. Phil and Marie expect to accompany **Phil Young** and his wife for the June festivities.

A welcome letter from **Charlie Klingler** of 4310 East Keim Drive, Paradise Valley, Ariz., says that he and his wife are enjoying retirement at this beautiful spot. He golfs, gardens and takes movies and color pictures during his extensive travels around the world. In the summer, the Klinglers go to La Jolla, Calif., and while there, get in touch with **John Keats** who now lives in Santa Barbara. They also have had pleasant visits with the Walt Whitmans, '17, who reside in Scottsdale.

Harold Bibber sends the good news that he and Mrs. Bibber are planning to be with us in June. Writing from his home, 2147 McClellan St., Schenectady, Harold says, "The past year has been an interesting one. Starting in February, I put in full time as acting secretary of the New York State Board of Examiners of Professional Engineers until a permanent secretary was appointed in the spring. Forty years of teaching engineering and nine years of practice were good preparation for the job." During the summer Harold enjoyed visits from his three children, coming respectively from Milwaukee, Des Moines and Alexandria, Va. Harold still receives visits from friends acquired in Japan when he spent a year or more there. "I anticipated returning to the research project on the use of solid-state power devices with electrical machinery which I had long conducted in the Electrical Engineering Department of Union College, but a new professor from abroad was delayed so I took over his work. This fresh contact with today's students showed me that in many ways there had been little change in them since '64 when I retired. I am still active in the I.E.E.E., serving as chairman of the committee of our local section to propose the transfer of members to the grade of Fellow. As one of the members of that grade, we have several nominees as we have over 1,400 members of the I.E.E.E. in Schenectady. In the Schenectady Society of Professional Engineers I chaired the nominating committee this year, am now on the program committee and hope to make some contribution to the work of the 'Professional Engineer in Industry' group in the New York State Society." It is pleasant and inspiring to witness this distinguished engineering educator continuing to make valuable contributions to his profession with unrelenting enthusiasm and vigor long after his retirement.

A warm letter from **Henry Massey** of Forest Beach, South Chatham on Cape Cod, encloses a snapshot of Henry dauntlessly skiing along the beach during the foot of snow they had in January. Coasting down a sand dune, Henry remarks, "I pity those poor guys that live in Florida, Arizona and California and never feel the tang of a 10° morning in New England. Or do I? I wish you could see Nantucket Sound with the bright sun shining on the sea and ice floes against Monomoy Island. We hope the ice will stay away from our shores so the ducks, brant and geese will have some place to feed. What foolish birds not to fly south!

"This past year was indeed eventful as we were presented with our second greatest blessing, two grandchildren, by a daughter and a son, each living on the Pacific Coast. That is a far cry from the fifteen Skeetz Brown has but at least it is a start. Our U.S. Marine captain flying on his second tour in Vietnam (450 missions all told) also took time out for a short honeymoon, his wife a California girl. What a landmark when all your children become happily married!" To which we say, Amen.

A pleasant note from **Archie** ("Toots") **Kinghorn** tells of moving from Berkeley to a charming cottage in Carmel-by-the-Sea, well located within walking distance of the beach. Having visited that beautiful town on the Monterey Peninsula a number of times we must admit we envy "Toots" that delightful location and look forward to a visit with him and Elvira one of these days.

Ray Reese was recently awarded honorary membership in the American Society of Civil Engineers. Ray began his professional career as a designer and later, chief engineer in the building department of General Electric Co. He was chief engineer for the Building Products Co. of Toledo, Ohio, for several years, then became chief engineer of the Hausman Steel Co. For the past 30 years he has been a principal in the Toledo consulting engineering firm of Raymond C. Reese Associates and has served as lecturer on structural engineering at the University of Toledo. Ray has made many notable contributions to construction design and standards. He was chairman of the committee that wrote the 1963 A.C.I. Building Code, and of the Engineering Practice Committee of the Concrete Reinforcing Institute. Says the A.S.C.E., "he has been both active and effective in providing liaison between the European Concrete Committee and the American Concrete Institute. A former president of the A.C.I., he holds several of the organization's awards." Ray resides at 743 South Byrne Rd., Toledo.

John Crowley, in case I haven't mentioned it, is in Jupiter, Fla., Box 606. **Charles Lawson** is at Royal Palm Club, Naples, Fla. **Ben Morse** is at 5801 E. Livingston Ave., Columbus, Ohio. "**Heinie**" **Haskell** now lives on Hilton Head Island, S.C., which has been much in the news lately. His address is Calibogue Cay.

George R. Knight, who was president of George Knight and Co. of Brockton, until recently at any rate, has elected to affiliate with the Class of 1920, thereby showing excellent taste and judgment. **Harry I. Granger** of South Weymouth, Mass., has also affiliated with our Class. We congratulate these gentlemen and wish them well.

As we go to press your secretary was delighted to receive a long distance call from our old and highly popular friend and classmate **Pete Ash** of Mahwah, N.J. Pete wanted to tell us that his health would not permit attendance at the reunion, much as he would like to be there, but he wanted to be remembered to all the boys. We shall most certainly miss him and shall earnestly hope for a speedy recovery.

Arthur Grosscup's wife Anna has very kindly supplied further news of Arthur's untimely death. Arthur, a resident of 525 Wayne Dr., King of Prussia, Pa., was associated with New York Shipbuilding Co. in Philadelphia and the Public Service Gas and Electric Co. of Newark.

His death occurred on September 2, 1969 after a short illness.

The death of **Saul Palais** of 166 Fisher Ave., Brookline, Mass. has been reported as of September 21, 1969. No details.

The Class has suffered a great loss in the death of **Ernie Huntress** on February 1, this year. Ernie was long prominent in M.I.T. faculty circles. He received his doctorate from M.I.T. in 1927, was Assistant Professor of Chemistry, Associate Professor of Organic Chemistry and became Deputy Dean of the graduate school in 1950. He was secretary of the graduate school at the time of his death. He served on the council and publications board of the American Academy of Arts and Sciences, and was a board member of the Technology Press. He was the author of five biographies of famous scientists and more than 100 scientific papers. He leaves his wife, Zilpha, a son Robert J. of Hingham, a daughter Mrs. Carol M. Tarr of Madison, Wis., and four grandchildren. He lived at 585 Franklin St., Melrose. In his long and distinguished career as educator and author he was an outstanding credit to his Class.

A final and poignant word from Ernie came to us a few days before his death. He wrote, "I regret that my health prevents me from taking part in the 50th Class Reunion. However, I send best wishes to all for a successful and happy affair."—**Harold Bugbee**, Secretary, 21 Everell Rd., Winchester, Mass. 01890

21

You should now have a notice of, and application for, Homecoming '70 at M.I.T. on June 14 and 15. We urge you and your wife to join our informal class dinner at the Charter House—Cambridge Parkway off Memorial Drive, about a mile from the Institute—on Sunday evening, June 14, when we will meet between 5:30 and 6 o'clock. You can either spend the evening with the '21 group or go to Boston after dinner for the Pops concert with Arthur Fiedler, for which M.I.T. is booking Symphony Hall. You will both be welcomed by the usual attenders from our Class at all the events on Monday. . . . We particularly urge you both to start planning now to "join '21 in 'seventy-one" for the biggest event of our alumni lives—the golden anniversary celebration of the Class of '21 to be observed for the most part on campus in Cambridge from June 10 through 14, 1971. The members of the Class will be the recipients of special honors from M.I.T. at this once-in-a-lifetime occasion, so begin your travel arrangements immediately to be certain you will not miss any part of our 50th reunion. For help and information, address inquiries to Reunion Chairman **George A. Chutter**, Box 305, Boulder Drive, East Dennis, Mass. 02641, or to any of your secretaries who always appreciate news from you.

Newcomen news

Of interest to the many of the class who are members of the Newcomen Society in North America is the introduction of Vice Admiral Hyman G. Rickover, U.S.N., by **C. Levon Eksergian**, who presented the admiral for the Newcomen gold medal "in consideration of his outstanding achievements and successes with the nuclear-steam powered submarine and in the application of the nuclear reactor to the steam power generation field in general." Were it not for the courtesy of our Class Vice President **Irving D. Jakobson**, we might have missed this choice item which took place on the occasion of the 263rd Franklin birthday dinner of the society early last year, when Admiral Rickover gave an address on "Liberty, Science and Law."

Levon, recipient of the Henderson Medal of the Franklin Institute and member of its committee on science and the arts, is a former consultant for Kelsey Hayes Co., Romulus, Mich., now retired and living at Sugar Trees Farm, R.D.1, Stillwater, Pa. 17878. Holder of more than 200 patents and author of several technical papers, he had long been associated with the Budd Co., Philadelphia, variously as head of the metallurgical laboratory, chief engineer and executive engineer in charge of production and research for all company products, ranging from farm implements to railroad and R.D.C. cars, automobile bodies, wheels and brakes.

He is an accomplished cellist, equestrian and farmer. He is not married. We hope he will relinquish enough of his busy retirement life to join his Course IX-B friends at our 50th reunion.

Jake also sent us news of Mary Louise and Rich Clark and reported that he and Ruth planned a motor tour of Florida this winter, where they expected to visit Muriel and George Owens, Graciela and Helier Rodríguez, Helen and Miles Zoller and others of the Class in the area.

The Jakobsons also told of a delightful dinner and evening with Vina and **Ray Cooper**. The Coopers now make their home at 14 Ash St., Garden City, N.Y. 11530, near their daughter, since Ray's retirement as general manager and executive engineer of the Produce Terminal Corp., Chicago.

Marine Corps valor

The Manasquan, N.J., *Coast Star* reports that Marine Corps First Lieutenant George D. Hawes, flight commander of a squadron of 17 helicopter gunships in Vietnam, has been awarded two Air Medals for heroic achievement and, later, the Purple Heart, when his ship was riddled by ground fire. George, a Lehigh graduate with more than a year's service in Vietnam, is the younger son of Alex and **Munroe C. Hawes**, 320 Boston Blvd., Sea Girt, N.J. 08750. Since his recent return, George and his wife, Janice, University of Western Florida, make their home near the New River

(N.C.) Marine Helicopter Base. The elder Hawes couple should by now be back from their usual winter trip to warmer southern spots and Munnie's annual golf game with Bob Waterman in Florida.

Pacific patter

A welcome note arrived on a card with a Grandma Moses rural snow scene sent by Catharine and **Harry P. Field**, Honolulu, saying: "This reminds us of Christmas spent in New England and New York. It is so different from our sunny Hawaii. We loved the snow then but think the warm sunshine suits us better now! Harry is better than he was last year but he continues to have difficulty getting around without a walker to support him. We are still talking of attending our respective 50th class reunions at Smith and M.I.T. in 1971 and we hope Harry will improve more so it won't be just a dream. Our newest resident is Professor James E. Forbes, '27, recently retired from teaching physics at M.I.T. Harry has been catching up on all the changes at the Institute." We echo the thoughts of everyone in sending good wishes to the much-loved occupants of Arcadia Apt. 1137, 1434 Punahou St., Honolulu, Hawaii 96822, and expressing the fervent hope we can all welcome the Fields at our golden anniversary observance next year.

Marge and **Jackson W. Kendall**, 401 Hermosa Pl., South Pasadena, Calif. 91030, have been constant and most helpful correspondents. In the fall they made their annual trip to Big Sur, Calif., and sent a picture of the Mill Creek area on scenic Highway 1, where they live 500 feet straight up over a rocky beach with an unrestricted view of the Pacific. Earlier, they had flown to Lisbon and spent three weeks touring Portugal, Spain, Morocco and Majorca. Then they flew to Geneva for another three weeks in Switzerland, Austria, the Italian lakes, Munich and a four-day voyage down the Rhine. They plan next a tour of the British Isles. Marge writes: "Jack is happy and our children and seven grandchildren are the same. Our lives go on as usual. Jack goes to the office every day (Bekins Van and Storage Co., Los Angeles) and doesn't know the meaning of retirement. The doctor approves, so I might as well not complain." The Kendalls have kept in touch with Helen and Ray St. Laurent by phone and we know the Saints are most appreciative.

From 5981 La Jolla Mesa Drive, La Jolla, Calif. 92037, comes a plea from Helen and Class Agent and Estate Secretary **Edmund G. Farrand** to visit them. Maxine and your Secretary had toyed with the idea of such a trip this spring but have postponed it until the fall, when we'll try to contact as many of the Class of '21 as we can—from San Diego to Seattle, we hope! Ed notes: "A year ago I was in the hospital with a ruptured disc that set up several long-lasting reactions. Gradually these have diminished and my eyesight has somewhat improved. This is why I have not been writing you

as much as I had wanted." Helen adds: "Edmund and I are alone again. Our son, David, went back to New Mexico to work for a man he likes and admires and who gave him his first job. However, he is only two states away and not seven as he was when we lived in Georgia!"

Ed says that at the halfway mark in this year's Amity Fund, total giving is lagging and he hopes that our stalwart supporters will come through with generous contributions, not only to help the Class of '21 swell our 50th anniversary gift but mainly to support M.I.T. at a time when privately endowed education is battling a financial crisis.

Incoming mail

Before leaving for their winter home at 8894 112th St. North, Seminole, Fla. 33540, Becky and **Elmer W. Campbell** made another of their famous tours to visit classmates in their native state of Maine. Says Elmer: "We called at the home of **Brainerd M. Jacobs** in Readfield, where he built a new home on moving from Wicasset. No one was home so we proceeded to South China to see Commander and Mrs. **Glenn H. Easton**, with the same negative results. In East Pitston luck was with us and we had a nice visit with **Willis L. MacComb**, Mrs. MacComb and their daughter, Millie, who makes a specialty of raising and developing new varieties of chrysanthemums. All three are fine gardeners and their efforts produce a riot of color over a large area.

"In Gray, we called on Mrs. Barbara Hughes, daughter of our Colonel **Harold O. Bixby**. She told us that he has moved from 100 Memorial Drive, Cambridge, and makes his permanent home at 2020 N. Atlantic Ave., Cocoa Beach, Fla. 32931." Becky and Elmer receive their mail during the summer via Box 3, Lovell, Maine 04051. They are regular attenders at affairs of the M.I.T. Club of Western Maine, Portland, as are Theona and **Albert S. Genaske**, 138 Main St., Fryeburg, Me. 04037. The Genaskes are planning a trip to Austria next month and we hope they will return in time for Homecoming at M.I.T. in June.

Louis Mandel told Assistant Secretary Sumner Hayward that he retired last August as president of Mandel Products, a Newark, N.J., firm he founded. Writing from Seacoast Towers East, Apt. 1719, 5151 Collins Ave., Miami Beach, Fla. 33140, Lou says: "I'm spending winters here and summers at Apt. 2A, 175 Prospect St., East Orange, N.J. 07017. I ran into **George Schnitzler** who still vigorously plays tennis. I'm still trying to improve my golf." Lou has an unmarried daughter, Marcia, and three grandchildren, daughters of the late Mrs. Brenda Gray.

Sumner Hayward also reports a note from Betty Patton, wife of the late **Norman F. Patton**. Betty says, in part: "Most of the year was spent on the League of Women Voters' 50th anniversary campaign. There was time for garden-

ing, needlepoint, trips to Florida, Cape Cod and Maine and socializing with good friends here."

The **Sumner Haywards** returned in mid-February from a month's stay in Christiansted, St. Croix, Virgin Islands.

Lawrence W. Conant, 4301 Massachusetts Ave., N.W., Washington, D.C. 20016, writes that he and **Robert F. Miller** "are planning to round up the '21 families in the District and adjoining Maryland and Virginia areas to attend our 50th Reunion. Bob and I hope to get some group pictures you might like to have for the Review." Thanks in advance, Larry and Bob, for whatever news items and photos you are able to obtain.

A. Abba Orlinger reports: "I was awarded the J. D. degree last year by Brooklyn Law School." Abba has his patent and trademark law offices at 2820 Graybar Bldg., 420 Lexington Ave., New York, N.Y. 10017, and, if the aged but last data sheet he returned is correct, he continues to live at 6655 McCallum St., Philadelphia, Pa. 19119.

Henry R. Kurth, retired vice president of steam and electric operations of Boston Edison Co. and now consultant to Jackson and Moreland Division of United Engineers and Constructors, Inc., Division of Raytheon, says he met **Donald A. Hatheway** in Boston and saw **Ed Dubé** and **Ace Rood** at alumni meetings. Laurie and Chick live at Apt. C85, 330 Beacon St., Boston, Mass. 02116.

A Christmas card with an attractive grouping of six happy youngsters marks a major change in the annual greetings from Helen and **Robert F. Miller**, Apt. 2C, Rossmoor Bldg. 50, 3386 Chiswick Court, Silver Spring, Md. 20906. The Millers have always pictured their good-looking children but Bob remarks: "The family has become somewhat scattered so we are showing some of the grandchildren. In 1970, I'll probably continue to work on a consulting basis for the Post Office Department. We had a visit with Emma and Al Lloyd in Westerly, R.I., but Helen and I were unable to see Helen and Ray St. Laurent in Manchester, Conn."

We have a copy of the annual color edition of the *Miami Herald*, a souvenir of "Orange Bowl Week," which has a feature advertisement of **Oliver L. Barden's** condominium community, the Bardmoor Country Club, 8000 Bardmoor Blvd., St. Petersburg/Largo, Fla. 33540, located east off Starkey Rd., between Ulmerton and Park Blvd. Here, near St. Petersburg, Tampa and Clearwater, Ollie has built the championship 6,773-yard course with "Bermuda turf fairways, velvet greens and challenging traps in evergreen woodlands studded with lakes, palms and yellow pines." The elevated full-service luxury clubhouse has a panoramic view of the course and swimming pool. Nearby are condominium villas in various styles with numerous unusual features including lifetime maintenance service and at attractive

prices. Write to Ollie at the above address for details of this new recreation and living center if you live or vacation in Florida or plan a trip there.

Dolce far niente

Retired years ago from the U.S. Navy with the rank of captain, **William C. Wade** also has retired as the senior associate of W. C. Wade Associates, Washington, D.C., naval architects. Bill now makes his home at Apt. 204, 280-126 Avenue E, Treasure Island, Fla. 33706. . . . **Norman Insley**, 36 Old Middletown Rd., Nanuet, N.Y. 10954, a former member of the technical staff of Bell Laboratories, writes: "I am now retired from all gainful labor but not the pursuit of profit. I may have to give up luxuries such as haircuts and become contemporary. So the cycle repeats!" . . . Anne and **George Schnitzler**, wintering at 1076 Venetian Way, Miami, Fla. 33139, say: "We are looking forward with enthusiasm to our 50-year class reunion but, at the same time, we are dismayed to have the years pass so quickly." . . . Eddie and **George F. Gokey, Jr.**, are just about to return to 98 Westminster Drive, Jamestown, N.Y. 14701 from their annual three-month stay in St. Maarten, N.W.I. . . . Marion and **Philip R. Payson**, 5031 Northampton Drive, Tanglewood, Fort Myers, Fla. 33901, report: "We are well and like it here; the place is growing fast. Both our daughters, Beverly and Audrey, were with us part of last summer—Beverly with her husband, Frank, and their three children. We drove up to Sarasota and enjoyed dinner with 35 members of the M.I.T. Club of Southwest Florida—no others from our class were present." . . . **Roderick K. Eskew**, Roseburn, Box 205, Spring House, Pa. 19477, advises: "We have recently completed our new home on Sanibel Island, Fla., where we expect to spend the first three months of each year. However, this year we leave in mid-January for a return trip to East Africa. Last year we were Kenya, Uganda and Tanzania photographing wild animals and wished we could have stayed longer."

A number of classmates have newly retired or have recently acquired a new retirement home. **James LeGrand** former structural engineer of McGraw Construction Co., Middletown, Ohio, has moved farther west and gives his retirement address as 625 S. Alton Way, Apt. 10B, Denver, Colo. 80222. Call **Dana E. Kepner** and say "hello" for us, Jim. His address is 550 Alcott St., Denver 80204.

Churchill K. Stiff, formerly consultant to the Factory Mutual Engineering Corp., Norwood, Mass., lives in Norton, Mass. 02766, where he can be addressed via P.O. Box 465. . . . **Morris B. Hart**, who was treasurer of Hart Products Corp., New York City, makes his home at 98 Stemmer Dr., Clark, N.J. 07066. . . . **Josiah D. Crosby**, who retired some time ago as senior development chemist of the B. F. Goodrich Footwear and Flooring Co., Watertown, Mass., has deserted New England for Apt. 9B, 3131 Bee

Ridge Rd., Sarasota, Fla. 33580. Say that you two will come back for our 50th reunion, Claudia and Josh!

Whitney H. Wetherell has gone back to his native Bay State after years in Syracuse, N.Y., heading the training department of Carrier Air Conditioning Co. Whit advises his retirement address is P.O. Box 384, South Harwich, Mass. 02661. . . . Emeritus Professor **Victor O. Homerberg**, who retired in 1950 after having served on the faculty of the M.I.T. Department of Metallurgy from 1926 and in the Department of Chemistry from 1919 to 1926, has been living on the West Coast. He now reports a new home at 256 Butterfly Lane, Santa Barbara, Calif. 93103. How is your flower gardening, Vic? . . . **Robert L. Moore**, a co-founder of the huge Sheraton Hotel chain and most recently a director and chairman of the executive committee of the Sheraton Corp. of America, gives a new home address at 179 Nashawtuc Rd., Concord, Mass. 01742. We assume this indicates retirement, Bob. . . . **Horace B. Tuttle**, who retired from the Johnson Asbestos Co., West Springfield, Mass., says he lives on Park Ave., Bloomfield, Conn. 06002.

Through Chick Kurth, we hear that **Richard McKay** has retired from United Business Service, 210 Newbury St., Boston, Mass. 02116, and has given up his home in Newton Center for a retirement location on Cape Ann—exact address unknown. Dick founded Securities Research in the early 1930s and brought it into the U.B.S. family as a division in 1966. Let's hear from you, Dick. . . . Kay and **Philip A. Nelles, Jr.**, 21 Sunset Rd., Stoneham, Mass. 02180, tell us Father Time is beginning to interfere. Phil had hernia operations last March and October and we are glad to know all is well by now. Worse yet, it seems, is that Phil's retirement activity as a trustee of the Stoneham Savings Bank is in jeopardy because Massachusetts does not permit reelection after age 72! Phil adds: "We were able to spend our longest period at our Cape Cod establishment last summer. You didn't show up, much to our disappointment!"

Kay and **Edwin F. Delany**, 8 Welgate Circle, Wollaston, Mass. 02170, remark: "Just got through reading the '21 class news in the latest *Review* and what a job you do! Thought we would let you two know that we will be riding down to Naples, Fla., in January with the Mich Bawdens and the Ed Ryers, '20, who go there each winter. On our way back in the spring, we will try to drop in on you in Brielle, hoping we do it better than last year." The class news could still be improved, Kay and Ed, if the bulk of our '21 readers would answer our letters, return those data sheets or volunteer their news to be shared with everyone, as you are kind enough to do! The latchstring in Brielle is always out for members of '21 who may be traveling either the New Jersey Turnpike or the Garden State Parkway, and we'll gladly supply detailed directions to

608 Union Lane to all itinerant members of the Class who inquire. Maxine and your Secretary will be certain to be home if advised in advance and we'll try to arrange for other New Jersey classmates to be present. We have recently taken short trips to Maryland for the observance of a wedding and several birthdays; a big one for your Secretary is being noted as these words are written and we will have a joint celebration with a near neighbor who, by coincidence, achieves the same age on Washington's Birthday. Next week we will journey to see Helen and Ray St. Laurent in Manchester, Conn., and hope to meet Marion and George A. Chutter there for some more planning of the '21 golden anniversary.

In Memoriam

It is with saddened heart that we record the passing of five members of the Class of '21 and extend to their families sincere sympathy on behalf of the entire Class.

Herman Francis Finch, of 100 Font Blvd., San Francisco, Calif. 94132, died on January 5, 1969. Born in Boston on October 17, 1899, he prepared at Mechanic Arts High School and was graduated with us in Course II. At M.I.T., he was a member of the Aero Society, the Mechanical Engineering Society and on the staff of *Tech Engineering News*. During World War I, he was a private in the S.A.T.C. at M.I.T. He had been a structural designer with Stone and Webster, Boston, until 1939, when he became a structural engineer on construction projects for the Panama Canal. In 1949, he became associated with the California State Building Standards Commission as supervising structural engineer concerned with building codes and standards. He was a member of the American Society of Civil Engineers, the Society of American Military Engineers and the Structural Engineers Associations of both central and northern California, which he served as chairman of various committees. He is survived by his wife, the former Lillian May Seasley of Arlington, Mass., and three sons, Robert F. Finch, University of Detroit, William P. Finch, University of California, and Richard A. Finch, San Francisco City College.

Kenneth Harnden Pratt, of 226 Ocean St., Lynn, Mass. 01902, died on March 1, 1969. A native of Lynn, where he was born on September 13, 1901, Ken attended Lynn Classical High School and was graduated with us in Course V. At the Institute he was active in the Chemical Society. Throughout his professional career, he served the General Electric Co. in various engineering capacities, both in Schenectady and West Lynn.

Glenn Stanton, one of our famous group of West Coast architects and senior partner of the architectural firm he founded, Stanton, Boles, Maguire and Church, 208 S.W. Stark St., Portland, Ore. 97204, died on October 16, 1969. He was born in Humboldt, Iowa, on May

17, 1895, and attended Jefferson High School there, moving to Oregon in 1912. He obtained the B.A. and B.S. degrees in 1918 and 1919 at the University of Oregon and the master's degree in architecture in Course IV with our Class. He saw service during World War I with and Army Signal Corps photographic unit in France and he had been a member of the American Students' Mission to Europe. He became a draftsman, designer, manager and partner of Morris H. Whitehouse and Associates, Portland, before opening his own architectural offices in 1935.

In 1955, he organized the current firm which he headed at the time of his death. He earned architecture's highest awards, including that of Fellow in the American Institute of Architects of which he was elected president in 1951.

Honorary Secretary of M.I.T., member of the M.I.T. Club of Oregon and chairman of its scholarship committee, he was the author of a series of 102 weekly articles on city planning for the Oregon *Journal* and had prepared numerous articles and speeches for the A.I.A. He never married and is survived by a sister, Mrs. Joseph F. (Lucille S.) Trowbridge, 422 Lone Plaza, 1717 S.W. Park Ave., Portland, Ore. 97201, and several nieces and nephews. We are indebted to Keith Maguire for aid in preparing these notes.

Eliot Wight Higgins, of 252 Clifton Rd., Birmingham, Mich. 48010, died on November 19, 1969. A native of Dover, Mass., he was associated with us in Course II in the sophomore year. He had been manager of the New York office of the Maxim Silencer Co. and then spent many years with Burgess Battery Co. as aeronautical engineer in Detroit and eastern representative in New York City. He became a manufacturers representative and consultant in Detroit before retiring in 1967.

Harold Kennedy Moritz, of 4500 N.E. 50th St., Seattle, Wash. 98105, died on December 9, 1969. Born in Nebraska on August 26, 1897, he attended Lincoln High School and the University of Washington before coming to M.I.T. in our junior year and receiving the bachelor's degree with us in Course II. At the Institute, he was a member of the Mechanical Engineering Society. He taught at the University of Nebraska before joining the faculty of the University of Washington in 1928, where he was professor in the department of civil engineering for 37 years and where his father had been a member of the mathematics department for 36 years. He specialized in hydraulics, retiring as professor emeritus in 1965. He was a member of Tau Beta Pi. Besides teaching, he had worked on various projects including the Navy dry docks at Bremerton, Wash., the Narrows Bridge, Fraser River Fishway, Coast Guard facilities, steam generating plants, a marine application of the Kirsten cycloidal propeller and sea trials of ships built at Astoria,

Ore. He is survived by his wife, Mrs. Melba L. Moritz; a son, Dr. H. Kennett Moritz, Playa del Rey, Calif.; a daughter, Mrs. Alan Pollock, Walnut Creek, Calif.; a brother, Donald Moritz, Tucson, Ariz., and nine grandchildren. Also surviving are four stepsons, E. C. Smedley, Paul Smedley, Vern Olson, Gary Olson and eight step-grandchildren. We are indebted to Mrs. H. Kennett Moritz for aid in preparing these notes.

For immediate action

Get reservations for yourself and your wife for Homecoming '70, Monday, June 15, on campus in Cambridge. Both of you are invited to attend the '21 dinner on Sunday evening, June 14, starting from 5:30 to 6 o'clock at the Charter House, Cambridge. . . . Above all, start making your travel plans at once so both of you can attend our one-and-only 50th anniversary of the Class of '21 from June 10 through 14 in 1971. Write for help and information and send news to your secretaries to aid in maintaining these columns.—**Carole A. Clarke**, Secretary, 608 Union Lane, Brielle, N.J. 08730; **Edwin T. Steffian**, Assistant Secretary, Steffian, Steffian and Bradley, Inc., 19 Temple Place, Boston, Mass. 02111; **Sumner Hayward**, 224 Richards Road, Ridgewood, N.J. 07450

22

Pompano Beach, Fla. . . . And now for the Bad News caused by the tropic sun shining on the sandy beaches of the Atlantic and the bronzed figure of your Secretary ogling the girls in their shockingly simple but attractive beach wear. We recommend this location for the winter Class House of '22 as it is exceptionally accessible and convenient for many of our classmates living in the vicinity. This report is also made difficult because of thoughts of a too early return to that invigorating and stimulating Buffalo spring-in-February. . . . We are still grieved about the brilliant but misguided article about the Buffalo football team in the CSM. We out-played Boston, out-ran them, had greater gains but still lost the game because of a few unlucky circumstances. We do not appreciate their funny which states that Buffalo is "the only refrigerator within 500 miles of the Arctic Circle which does not have a door."

We are glad to hear that **William L. Hyland** is still active as vice president of Fay, Spofford and Thorndike, Inc., in Massachusetts. **William K. Freeman** of Salem, Mass. is continuing to teach Latin and math but recently helped "earn" \$142 by taking part in a 19.6 mile Walk for Charity from the Tower School in Marblehead to the Pike School in Andover. This Walk was a trial for the "Builder-Uppers" of the Tower School as they challenged the Pike School in the spring. The start was at sunrise and the time from flagpole to flagpole was 7 hours 56 minutes, or 2.5 miles per hour. Sounds like my doctor's prescription!

We have heard that **F. W. (Dino) Spaulding** of Cincinnati has been elected Chairman of the Retired Engineers and Scientists Group of the Engineering Society of Cincinnati. They have monthly meetings for their eighty-two members with a luncheon followed by a panel presentation and forum discussion. . . . We congratulate **Stephen B. Neiley** on his marriage and move to South Yarmouth's Blue Rock Golf Course section. **Charles S. Comey** of Sunset, Ariz., writes that he has experienced the "hottest summer on record" but finally took off for Jackson, Yellowstone, the Black Hills and Duluth. Then he drove to the Bruce Peninsula and through Buffalo to New England to visit relatives.

Norman L. Apollonio of Camino, Calif., tells of his bumper fruit crop of pears, apples, blueberries, raspberries, plums, apricots and peaches on his ranch. He makes it sound like an appetizing breakfast! . . . A review of clippings again tells of **Horace W. McCurdy** as Construction Man of the Year of the Seattle Chamber of Commerce. He was honored for his achievement in public service, service to industry, public relations and the science of design. Mac is chairman of Puget Sound Dredging Co., a director of Lockheed Aircraft Corp. and director emeritus of the Pacific National Bank in Seattle. **Walter W. Boyd** of Bethesda, Md., is still proud of his degrees at the Institute and of being one of the founders of the M.I.T. chapter of Tau Beta Pi.

Martha E. Munzer is an associate of Wavehill Center for Environmental Studies in Riverdale working with high-school students on rudimentary research of air pollution. She lives in Mamaroneck, N.Y. **Clinton B. F. Brill** and Mrs. Brill of Tallahassee spent last fall in Belgium, Switzerland, Spain and Portugal. They were delighted to visit with a few M.I.T.'ers on the way. **Russell E. Randall** of Pasadena, who is Class of '23, retired in 1967 and has taken up drawing and painting as well as the study of several foreign languages. He sends special regards to those who lived in the old Kappa Sigma house on Commonwealth Ave.

Any time **Morris H. Gens** of Boston is "just loafing around" it will be surprising. Morry is fully retired from the electrical business but is still a very active member of the clan. He was able to help your Secretary recently with a mutually satisfactory electrical problem.

Julian Lovejoy of Manchester, N.H., with wife Charlotte and youngest daughter Sally has taken a very enjoyable journey by boat up the Inland waterway from Vancouver, B.C. to Skagway. On return they called on their daughter Nancy with husband and children in San Jose, Calif.

We were delighted to read of an M.I.T. Special Award being given to **Oscar Horovitz** in appreciation of his 1969 Alumni Fund efforts. Oscar has always been generous in his loyalty to the In-

stitute. **Robert Tonon**, our anchor man in Cambridge, has been elected trustee of Lesley College and also has been named to the corporation board of the New England Deaconess Hospital. Bob continues his usual activity of working for good causes. **William H. Lang** of St. Paul is president of Foley Bros., Inc., and director of General Mills. He has been a member of the sponsoring committee for the Underwood-Prescott professorship in the Department of Nutrition and Food Science at M.I.T. This will be the first endowed chair in the field of food science in the United States.

Among the new addresses received are Dr. Walter M. Saunders, Jr., Cape Elizabeth, Maine; C. Harald Sebenius, Pasadena, Calif.; John F. Pierce, Clermont, Fla.; Thomas P. Wynkoop, New York City; Arthur L. Wasserman, Hartford, Conn.; John W. Poole, III, Jeffrey Center, N.H.; Arthur L. Pitman, Naples, Fla.—**Whitworth Ferguson**, Secretary, 333 Ellicott St., Buffalo, N.Y. 14203; **Oscar Horovitz**, Assistant Secretary, 45 Gerard St., Boston, Mass. 02119

23

We have much belated news of the deaths of two classmates: **Paul L. Wilkins** of 369D Portsmouth Dr., Lakewood, N.J., on July 24, 1969 and **Fred H. Travers** of 8206 Douglas Rd., Philadelphia, Pa., on December 10, 1969. When we have further details we will advise.

Pete Pennypacker writes: "In response to your request, I enclose herewith a jingle that I read at the fifth reunion of our class which was held at the Corinthian Yacht Club, Marblehead, Mass., where we had a large and lively turnout on June 28, 1928. . . . To the serious world around us these days, the jingle, more or less spontaneous, is just so much nonsense; but I, for one, thoroughly enjoyed the outbursts of fun for which I believe our Class was generally noted. . . . A number of our classmates have really made their marks in their respective fields of endeavor and have contributed much to the progress of the world." So with some more or less tacit approval from the *Technology Review* editorial staff, we quote four stanzas from Pete's 41½-year-old poetic effort:

Classmates of 1923 assembled here today,
We've come to have a jolly time and fling
our cares away
Turn back your thoughts with me awhile,
recall the days once more
When life was full and hearts were free
along the Cambridge shore.

The Field Day caps of blue and gold, to
show our enterprise,
Our section representatives to help us
organize;
The mock convention in the spring, the
banquet Freshman year,
"The Three Brass Balls" by Eddie
Schmitz—the song we loved to hear.

In Junior year, the Technique Board
which caught the famous "Snique",
The Technique Rush with shower bath
that started Junior Week;
And best of all the Junior Prom that went
from nine to four,
Where many fellows learned to dance
who'd never tried before.

The Senior year with all the fear of coming graduation,
The Senior paper, Senior Week, our
picnic celebration,
The caps and gowns and other things too
numerous to mention:
Our class day with the rifle squad, the
Class balloon ascension.

All eight stanzas are available for **Art Davenport** to include in the Class History when he is ready to get to work on the effort for which he volunteered.

And now to continue the rhyming we have word from **Miles Pennybacker**, who writes: "I am pretty much retired from money making and too busy for money spending for trips, etc. I am treasurer and fund raiser for Joseph Duffey, a young and, I think, very promising challenger for Senator Dodd's seat. If any classmate, in or out of Connecticut, is interested, I'll be glad to fill him in.

John H. Thompson communicates: "I retired from my position as division superintendent for Public Service Electric and Gas Company (New Jersey) in early June. I now find myself busier than ever before. Have just completed a successful United Fund Campaign as chairman of the industrial division and have gone from that into the organization of a historical society here in Moorestown. It's real fun!"

We see by the magazine *Businessmen in the News* that **Alfred E. Perlman** has retired from his job as president of the Penn Central Co. A Bell System man is replacing Al hoping to do something about the P.C.'s money losing rail operations. We told Al in this column about a year ago how he could pick up a little revenue in Grand Central passenger operations but we guess Al missed it.

Augustus H. Hermann is making himself famous in the paint industry according to the *American Paint Journal*. Gus has been with the firm of Samuel Cabot, Inc., of Chelsea, Mass., since 1924 when he joined the firm as assistant plant superintendent. He became plant superintendent in 1949. Gus has been extremely active and ingenious in the field of automated materials handling, achieving outstanding cost and manpower savings for the Cabot Co., which he has so ably served for many years. He has also served as president of the Boston Chapter of the International Material Management Society and is active in the affairs of the National Paint, Varnish and Lacquer Association.

We have two items from **John Ward Beretta**. The first concerns the presentation to Washington (D.C.) society of his

daughter Jacqueline at the National Debutante Cotillion last Thanksgiving. Among 43 young women presented at the ball, Jacqueline is a graduate of the Cathedral School for Girls in Washington and is presently a freshman at Trinity University. Congratulations to proud pappy as he escorted his beautiful daughter into the spot-light. Those of you who attended our 45th on Cape Cod will remember John's daughter.

The second from John covers the wedding of **Abbott L. Johnson** to Mrs. Dorothy Petrovich McClennen of Phoenix, Arizona on December 31, 1969 at the winter home of Mr. and Mrs. R. Miles Warner in St. James Parish, Barbados, West Indies. Attending the ceremony were four grandchildren of bridegroom Abbott: Jimmie, Janet, Liz and Davis and the daughter of the bride Miss Emery McClennen. The happy couple will be at home, 80 Warwick Road, Muncie, Indiana 47304. Congratulations to classmate Abbott—may you enjoy many happy years!

We are sorry to hear of the death of **Elmer C. Strayer** of Alhambra, Calif., on October 18, 1969. We send our sincere sympathy to his family and friends.
—**Thomas E. Rounds**, Secretary-Treasurer, 4 Deer Hill Dr., Danbury, Conn. 06810

24

Retirement has caught up with two more of us. On January 1 **Frank Manley** became the ex-president of the Fitchburg (Mass.) Gas and Electric Light Company. The Manleys wasted no time in leaving this frigid New England winter behind. They left immediately for their new home in Sarasota, Florida. . . . Professor **Robert P. Siskind** is the second. For 32 years he has been teaching electrical engineering at Purdue. Officially he does not retire until the end of June, but beginning in February he went on terminal leave. Very nice departure present, five month's vacation with pay.

Since you probably do not read the Class of 1915 notes with any regularity, you missed an interesting reference to us last December. Seems that **Russ Ambach**, for some reason, sent the '15 Secretary, Azel Mack, a copy of the report of our reunion. He commented: "It's good to see this younger class enjoy such a gay and successful reunion." So the next time you're feeling the weight of your years, remember that you're a relative youngster to someone. For that matter, so is Azel.

More retirement moves, and this time Florida outdrew Cape Cod three to one. **H. Easton McMahon** is now in Boca Raton, **Percy D. Fuller** in Miami, and **Douglas Montgomery** in Maitland. Retirement is assumed in each instance merely because of address changes. Of course Dr. McMahon could practise cardiology in Florida as readily as New York, marine engineer Fuller might be operating a fleet of charter boats, and

electronics expert Montgomery would probably find a demand for his skills anywhere. But until we hear to the contrary, we'll stick with our first assumption. The only one we're sure of is the move to Cape Cod. Colonel **Bill Sturdy**, U.S. Army (Ret), has now settled down in Truro.

Thomas K. Sherwood has been retiring from M.I.T. for a long time. First he stepped down from the post of Dean of Engineering to devote full time to teaching. Then he reached mandatory retirement age and went on a half-time basis. Now he is fully retired from M.I.T. and has started all over again in California. Berkeley seems to have no age limitations where M.I.T. faculty are concerned. Tom is not the first to follow Horace Greeley's advice somewhat belatedly.

Now for a few follow-ups. We told you that the **William MacCallums** were planning a Caribbean cruise this winter. Now we can assure you that it did, indeed, materialize. In February came a letter from the Holland-American *Statendam*, just leaving Puerto Rico. "This morning we made a four-hour stop in Poncé. We went to the Art Museum and were surprised to find the most beautiful building designed by Edward Durrell Stone '27, and donated by the Luis Ferré Foundation. The art is superb—it is a real gem." (If Bill read these columns as thoroughly as he should, he wouldn't have been in the least surprised.) We also drove by Luis' home in this most attractive city, as yet unspoiled by tourists. In most ports the cruise ships run like busses in fleets from one place to another. All nations are represented—French, Greek, Yugoslavian, East German, West German, Dutch, etc. Also all sizes from the *France* and the *Queen Elizabeth II* on down. They are really spoiling the charm. It's like an Arabian bazaar." So of you're planning a cruise and want to get away from the milling mob, look up Lindblad.

We also told you about **Ted Kenyon** and his camera-binocular stabilizing gyros. Ted is an inventor, not a manufacturer, so now he's about to sell that line to another outfit. So what's next? Never let it be said that President Kenyon of Ken-Lab Inc., is not in tune with the times, so of course it has to be computers. "Have now designed a computer for the film processing industry, selling it through a large company in the business." Well, if computers can land men on the moon, there's certainly no reason why they can't develop film, maybe even correct the mistakes of the photographer. "Guaranteed: A Perfect Print Every Time with Kenyon Computer Control." (Shortly after writing this flight of fancy the Sunday paper arrived. An article on the Tech Film Corp. of Waltham, Mass., headed by William J. McCrea, '61, ended with these words: "The organization . . . maintains specialized laboratories for the processing of film wherein correction can be made for improper exposure and other required adjustments." There are no absurdities any more!)

We were correct about retiring **Bill Sturdy** to Cape Cod. What we didn't know at the time was that they are sort of camping out at the moment. "We are living in a rented house in Truro while I, acting as prime contractor, am coordinating the building of a year-round house on Massachusetts Bay, also in Truro. We hope to move into the new house in May 1970." Do hope they make it, but after listening to the hair-raising experiences George Dandrow, '22, had with contractors and town fathers in nearby Chatham, there may be cause for concern. If Bill's experiences are anything like George's, he may still be renting in May 1972. The Dandrows, by the way, finally gave up and moved to New Hampshire.

When **Howard Whitaker** took on his first assignment for the International Executive Service Corps, it meant spending January in Korea. That was a year ago, and this year he picked his location more carefully, ten weeks of wintering in the Mediterranean, specifically Greece. "It is a lot of fun, and at least five of our Mead retirees have had similar experiences. In most cases we take our wives with us on these trips, and our only problem is that they want to know when we are really going to 'retire'. In our own case, we bought a place in Pebble Beach, California, some years ago, with a view to living there after retirement. Last year we spent exactly one week there." That doesn't mean the Whitakers are on the go all the time. They still have their main base in Chillicothe, and evidently prefer Ohio to California, even in winter.

The January lunch of the New York group had nine in attendance, Messrs. Bagby, Cardinal, Crafts, Gress, Lassiter, Lewis, Maynard, Schooler, and Stevens. There is no formal organization, but notices are sent regularly to prospects and suspects. For the last three to four years Howard Stevens has been doing this, always at his own expense. He certainly deserves a vote of thanks from all concerned, preferably accompanied by the award of a Laurel Wreath, First Class.

Paul Cardinal didn't get a Laurel Wreath, but he did get an impressive endorsement from the officers of the Upper Montclair neighborhood Fairway Association for his "outstanding and superior leadership" as two-term president. After a few well-chosen words of appreciation it concludes with: "Moreover, we want him to know that he holds our affectionate regard as a great guy who did a real good job and we unanimously direct the secretary of the Association to spread this communication on the minutes of the Fairway Association." So there's our Paul, spread all over the minutes. Probably better there than the Fairway itself.

Fred S. Hungerford graduated in mechanical engineering. You may remember him best as manager of crew or in the M.I.T.A.A., but he was active in many organizations. For many years he was with Allied Chemical and Dye, but in 1948 Fred joined the New York State

Department of Public Works as a Heating and Ventilating Engineer. He had the title of Associate Mechanical Construction Engineer in the D.P.W.'s Syracuse office when he became ill early last fall and, on October 10, died. Since he had always been in very good health it was a distinct shock to his family.

Kendall B. Castle, Jr., was another mechanical engineer who also went back home to New York state after graduation. For many years he worked as an engineer for the Rochester Gas and Electric Corp., with time out for five years in Army Ordnance during WWII. Somewhere along the way he became actively interested in the glass bottle business, and was chairman of the board of the Castle Hanson Corp. in Rochester. On November 22 last he died.

Your secretary knows little of **J. Robert Powers** who died in Ridgewood, N.J., on December 5. He was not with us long as a student, and received no degree. It is known that at one time he was a sales representative for Baker Perkins, Inc., but at the time of his death he was retired.

Shortly after these notes had gone off to the *Review*, belated word came that **Bob Siskind** died on January 12 after a month's illness. He never got to enjoy retirement, not even that terminal leave. . . . To the families of all these departed classmates go the sympathies of the entire Class.—**Henry B. Kane**, Box 177, Lincoln Center, Mass. 01773

25

By the time you receive this copy of the *Review*, there will be only a few weeks left for reunion planning. You have probably heard from Ed Kussmaul as to the numbers who have already responded and others will have received follow-up letters begging for their response. Just before going to press with this material, I met with Ed and Jim Howard, and they are both very busy making reunion plans. When Ed assumed the chairmanship of the Reunion Committee, he asked Willard Gardiner to take over as historian for him, and we hope you will quickly respond to a short questionnaire which should have reached you.

I am reprimanded upon occasion for not keeping classmates informed as to my activities while in semi-retirement. I spend three days a week on the average at M.I.T., supposedly working for the Comptroller, and hopefully accomplishing a few things worthwhile from his point of view. I am completing my second year as chairman of the Engineering College Research Council, one of the councils of the American Society for Engineering Education (ASEE). In this capacity, I serve also as a vice president of ASEE. On June 30 next, I will have completed my assignment with ASEE and will sort of retire from the Research Council after serving on its Executive Board for eleven of the last twelve years. I am still allowed to carry on as the director

of the Lowell Institute Evening School with which I first became associated in 1959.

It was noted in the Boston newspapers in January that **Maurice Freeman** has retired as Chairman of the Board of Loomis Sayles & Co., Inc. . . . A recent note from **Robert (Bob) Read** indicates that he has moved to New Brunswick, is busy building a house, clearing and equipping a ski slope, curling four nights a week, and handling his firm's government contracts in Europe and South America.

Milton G. Salzman begins by saying that he has generally been loafing since retirement, but he seems to belie that fact by noting that he indulges in various hobbies and home chores, maintains professional contacts by reading and attending technical meetings combined with an occasional "busman holiday" trip to power projects. He has taken a vacation to Freeport, Grand Bahama Island, where he appears to have left some of his retirement income at the gambling casinos. In the past few months, he has been occupied on a part-time basis with his Village Building Department, checking plans and permits for new building construction. He still finds time for fishing, golf and barber-shop quartet singing.

Walter C. Ames very modestly writes that he has retired and is living a quiet life in the country, in the neighborhood of Mathews, Va. . . . **Harold Washburn** writes that he is still on the Electrical Engineering Faculty at California State College at Long Beach, and consults with the Jet Propulsion Laboratory of Cal Tech in the field of Mass Spectrometry. He indicates that one of these days he will be analyzing lunar and comet atmospheres with the Mass Spectrometer.

Archer M. Nickerson, Jr. wishes to convey his regards to all of the members of the Class of 1925 but indicates there is nothing new to report. . . . **John P. Ramsey** tells that he retired as of August 31, 1968 and promptly moved from Connecticut to the northwest corner of South Carolina where his mail address is Seneca, S.C. He actually lives nearer to Clemson (the seat of Clemson University). He says "Wonderful people, wonderful climate, and we love it!"

A note recently arrived from **Henry Sachs** datelined Williamsburg, Va., January 22, 1970, with the following information: "The Council on Social Work Education yesterday conferred its Distinguished Service Award, for volunteer service in social work education and social welfare practice, on Henry N. Sachs, secretary of the council's board of Directors. The award was presented at the council's annual meeting by James R. Dumpson, dean of the School of Social Service, Fordham University." Henry is certainly to be congratulated for the good work he has been doing over the past years; and it should be noted that this is the highest national award for social work

education, and this is the first time that a lay person rather than a professional social worker or social work educator has received it. The award includes a gold medal.

Notes from various classmates received via the Alumni Fund Office are most welcome. **Cornelius Enright** notes that he has retired and is working on a charitable project for the Merry-Go-Round, Inc. This is a hotel for elderly people. . . . **Fisher Pearson** who retired as of January 1, 1969 after 26 years with *U.S. News and World Report*, the last 13 as the New England Advertising Sales Manager, also notes that he has a wife, four children, two dogs, and no grandchildren. He now resides in Weston, Mass. and has discovered that Chick Kane, '24 is a neighbor close by in Lincoln. . . . It was a real pleasure to hear from **Hollis Ware** who reached retirement age last July with the Federal Electric Corporation, a subsidiary of ITT. Since his company permits extension of active employment by mutual consent, Hollis applied for and received an extension. About three months later, a corporate reorganization established a new Division, ITT Arctic Services, Inc. to operate the DEWLine, BMEWS, and "White Alice" (Alaska Communications Network). He was promoted and transferred to this Corporation as Supervisor of Compensation, and expects to continue for another two or three years. . . . From **Don Taber** comes the word that the big special event during the past year was his 40th wedding anniversary in August. By now Don and his wife are at their apartment in Boca Raton, Fla. He is one who has already indicated that he will be at the 45th reunion next June.

From **Stanley C. Lane**, a high school classmate of mine as well as a member of the Class of 1925, comes word that he retired in 1966 after 36 years with the Esso Research and Engineering Company. After spending two more years working in the paper industry, he finally left the metropolitan area and following the precedent set by Mr. Blandings, he is remodeling an old colonial salt box farm house for a retirement home way down east in Surry, Maine, across the bay from Mount Desert Island. Many of you perhaps remember that Stan's daughter joined us at the 40th reunion on Cape Cod. She received her M.D. from Cornell Medical School in 1968 and is now doing a residence at Mary Hitchcock Hospital in Hanover, N.H.

Joseph P. McCarthy is now in the seventh year of an enjoyable retirement, and had a wonderful South Pacific cruise in 1969 which provided him an opportunity to visit with friends in Los Angeles and San Francisco. He keeps busy with his many hobbies which include golf, bridge, coin collecting, the Old Guard and grandchildren. . . . **Alexander Brown** has retired from Emery Industries, Inc. and states that he is still moderately active as a consulting engineer. . . . A short note from **William Steinwedell** indicates that he will be at the 45th reunion.

Several address changes are of more than passing interest. **Garvin "Chink" Drew**, our hard-working Class Agent, has deserted the east coast and is now at a new address, 31792 Isle Royal Drive, Laguna Niguel, Calif. 92677. . . . It begins to appear that the Class of 1925 perhaps should have a branch on Cape Cod because an address change from **Ralph B. Norton** lists him as being at Whittemore Point, RFD, Buzzards Bay, Mass. With **Ken Proctor** in South Yarmouth, **Paul Goble** at Chatham along with your secretary, we have the start of a club at least!

On a serious note, I am sorry to report the passing of two classmates. **Douglas D. Donald** in San Diego, Calif. on November 5, 1969, and **Forrest B. Kent** in Jamaica Plain, Mass. on December 21, 1969.—**F. L. Foster**, Secretary, Room 4-144, M.I.T., Cambridge, Mass. 02139

26

There is a wild winter snow storm churning up the sea and I'm down away from it in the study with a colorful fire of sparkling driftwood on the hearth. But this month, there is a subject which must come before the letters from classmates. When we were taking freshman English 47 years ago, I recall having one of the few conferences—perhaps my only one—with a professor. I probably had been doing poorly. In any event I recall asking him, "Why do I have to take English in a technical school?" I also recall that the ("Mollie" Pearson) was most understanding and in essence replied, "Perhaps someday the need will arise for you to become eloquent." He was right many times but never so right as now.

Many of you have written and phoned for information and assurance about affairs at the Institute. My thoughts do not properly belong in class notes so I am sending them even though they lack the desired eloquence as a Letter to the Editor (see page 92 of this issue—Ed.). However, one special thought is called for here: as classmates of a key member of the administration, I know that each of you would dearly love to share his burdens during these trying times. We know that this is impossible but we can give him and the rest of the administration our support by letting them know that we are proud of their stewardship of our Institute and its guidance through troubled waters. I hope that all of you will continue to write or call me, as your Class Secretary, when you are concerned, and I will gladly dig out any answers I can to your questions as well as be honored to pass along any expressions of support you may have for an administration that is handling the situation as we would expect M.I.T. to handle it.

We still have many nice letters to be incorporated into the notes, from Larry Cumming, Dwight Woods, Chet Buckley, Ben Richardson, Bob Richardson, Tony



G. D. Jackson, '27



E. D. True, '27



R. W. Davy, '27



F. Coburn, '27



L. H. Coffin, '27

Gabrenas, Al Landau and lots of those back of the envelope notes. But for this month we have occupied enough *Review* space. Next month too we hope to have a thought to spring on you about our 45th reunion.

The driftwood fire is now embers, the snow is deepening and this copy must be on its way. So cheerio until May and less stormy seas.—**George Warren Smith**, Secretary, P.O. Box 506, Pigeon Cove, Mass. 01966

27

Richard W. Davy, a leader in South Texas oil affairs, died last June in Corpus Christi, Texas, which had been his home since 1933. For 30 years, he had been a member of a team which directed several important Corpus Christi businesses. For many years he was president and chief executive officer of Pontiac Refining Corp., until that company was sold to Celanese. He was also president and chief executive officer of Great Southern Chemical Corp., a joint venture partly owned by Pontiac Refining and Gulf Oil. At the time of his death he was director and executive vice president of the Sequoia Refining Co. Dick was born in Atlantic City and, at the age of six, moved to France with his mother. He received his elementary and high school education in Dresden, Germany and entered M.I.T. at the age of 16. He earned a degree in geology and geophysics. Always active in M.I.T. and civic affairs, as well as his business commitments, he was at his office until 36 hours before his death from a rare type of cancer. With his permission, his doctors had conducted needed research in this unusual case. His widow, Mrs. Clara Robinson Davy, has asked to be kept on the M.I.T. mailing list, suggesting "maybe I can encourage young Richard Davy Weber to follow in his grandfather's footsteps."

When I previously reported the death of **Ed True**, time did not allow any but the briefest mention. Ed was a director and first vice president of the First Federal Savings and Loan Association, the co-owner of Hallet's Drug Store in Bath, Maine, and a member of the board of advisors of the Salvation Army in Bath. A

charter member of the Bath Lions Club, he served as treasurer for many years; he was a past president of the Girl Scout Council. Ed was born in Bath and attended Bath schools before going to Chauncey Hall, Boston, and then M.I.T. At Tech, he was general manager of Tech Engineering News, vice president of the Institute Committee, and a Field Day Marshall. Following graduation, he joined Hobart Manufacturing Co. in Troy, Ohio and was office manager of the New York office in 1940, when he left to return to Bath and join his father in the operation of A. Hallet & Co. Since 1961, Ed's son, Edward D. True, 2nd, has worked with him in the business.

Dike Arnold notes that the memorial service of **Glenn Jackson** was held in the library of the Jackson Family home in Amherst, N.H., rather than in Wellesley Hills as was reported in the February issue.

Larry Coffin retired from the Goodyear International Corporation in January. He joined Goodyear after graduation and spent many years in their manufacturing operations overseas, principally in Argentina and Brazil before the war and later traveling out of the head office to all parts of the world. Now he is moving from Akron, Ohio to the shores of Frenchman's Bay, near Bar Harbor. His address will be Bay View Drive, Bar Harbor, Me. 04609. Larry says: "Any of the class of 1927 who remember me or otherwise will be more than welcome." . . . On a Christmas card **Wes Meytrott** writes: "Well, Joe, that time has finally arrived when I'm retired". He promised to send on more details as they develop and I'll be passing them along in the Notes. . . . Although Dike Arnold advised us all by letter of the Certificate of Appreciation which **Dick Hawkins** won for his outstanding work for the 1969 Alumni Fund, I want to mention it too. Dick has been doing a wonderful year-after-year job and his results have been outstanding. I know Dick would want me to mention here that this is no longer 1969. This is 1970 and we should make our 1970 contributions as big and as promptly as we can.

Dyce (now "Jim") Coburn has retired as director of purchases of Colorado Fuel & Iron, completing 42 years of service in

the iron and steel industry. He and his wife, Bee, are not planning to move from Pueblo, Colo. (3103 Country Club Dr.), but plan to do some traveling in the U.S. and abroad (and I hope they will write some interesting letters like Erik's). Good luck, Jim!

Want to buy a farm or estate, industrial or commercial property? **Moe Smith** is in that business in Bucks County, Pa. and central New Jersey. . . . After living in Baltimore for 40 years, **Randy Petersen** has moved to Rochester, N.Y., to be near his son, daughter and grandchildren.

Vernon MacKenzie retired as Assistant Surgeon General, U.S. Public Health Service in July, 1968, and then worked as a special consultant to the Federal Department of Health, Education and Welfare for a year. Now he and his wife, Alice, have been enjoying the "climate, fishing and shelling at Sanibel Island, Florida (Rte. 1-Box 335, Light-house Way) along with some intermittent traveling incident mostly to consulting work." . . . **Bill Felch** writes, sending his best regards to all and advising that he really doesn't want to retire from A.T.&T. but it is going to happen to him April of this year. . . . We nominate **Ed Damon** for president of the Freighter Travel Association. Just about now he is en route to Australia via the Orient and southeast Asia. Keep sending cards, Ed.

Arthur M. Hill has moved from Albuquerque, N.M., to 1509 Burbank Ave., Richmond, Calif. . . . **Andy (Elmer) Andrews** still living in Rochester, N.Y. but now wintering in Deerfield Beach, Fla. . . . **Charlie Smith** has turned over the operation of his company to his sons, Chris and Chuck. Last summer the Smiths were in Canada and this winter in Green Valley near Tucson. Next fall they have plans for Oberammergau. To quote Charlie: "It certainly is great to have little to do after 42 years in industry." . . . **George Houston** has checked in, just to say "all is well," and that's a lot!

A publication of Dresser Industries, Inc. has featured **Bill Kaplan's** part in setting up just the right fuel for Mario Andretti when he placed first in the Indianapolis Memorial Day auto racing classic. This is

a specialty with Bill. His first experience in racing fuel development came when he was chief of American Oil's automotive laboratories in Baltimore in the 50s and was sent as consultant to the sports-car racing at Sebring, Fla. In 1969, Bill was on hand for every U.S. Auto Club championship race. . . . Last year **Howard Ferguson** went south in March; this year he seems to have had an earlier start as I have already received this address: Sun 'n' Sea, 4651 Gulf of Mexico Dr., Sarasota, Fla.

Joe Melhado, our class historian, was the first fellow I asked to take over the Notes while my wife and I go to the Orient—and he has accepted. He will complete these Notes and write those of May and June. His only stipulation was that I write two letters saying what we were doing. This I did agree to do. So I'll shed my reportorial responsibilities for a while and turn the microphone over to J.H.M.—Joe Harris.

It would be a good experience for every member of the Class to take over the job of class secretary for a month or two, just so he could begin to appreciate the tremendous job Joe Harris has been doing all these years. I'm just getting started with these few supplements to the above notes, and I'm impressed. . . . **Joe Harris** left Mystic on January 23 and is scheduled to return about April 20. It is a cruise to the Orient on a freighter, and I must admit I envy him. Except for those of us who have already retired, how many have ever had three whole months, since school days, to spend doing nothing but enjoying life?

The December issue of EG&G's house organ, *EGGlink*, reported on an oceanographic research project last fall on the Russian research vessel *Akademik Kurchatov*, in which **Harold Edgerton** and other members of EG&G's Geodyne Division participated. It was a two-month cruise to obtain information on the mid-Atlantic Rift Valley, which extends above Iceland, around Africa, the Red Sea, and the Indian Ocean. Harold's group used some specially-developed Geodyne oceanographic equipment to study the ocean floor. This is a rather rare example of Russian-American scientific cooperation.

John C. Parker on October 7 addressed a group of more than 400 business and community leaders at Westfield, Mass., on the subject of New England Ghost Houses. John Parker was the designer of the famous memorial arch on Flirtation Walk during the ten years he spent as resident architect at West Point. . . . In February **Dr. Christian V. Holland** was elected a Fellow of the American Institute of Chemists. . . . **Don Horton** has retired from the Federal Government. Most of his work since graduation was as a civil engineer with the Department of the Army, including many years in the water resources development program of the Corps of Engineers. He is a Colonel AUS-Ret. . . . Three other retirements are noted (We are all getting close): **Ed Cahill**, **Walter D. Burger**, and **Al Buffum**. Walter reports that he is now spending his time seeing the world. Al writes that while he is theoretically retired, he will continue through the end of 1970 as Director of Special Projects. He is a fishing enthusiast—fishing in Alaska and Newfoundland last year, and planning on British Honduras, Gods Lake, Canada, and Iceland this year. . . . **Ted Ordman** and **Frank Connolly** report that they are still on the job.

Your secretary has received some recent address changes of classmates and lists will be available to anyone who requests them.

Let me hear from you, so that Joe won't be ashamed of the class notes when he gets back, and so that he will have some kind of a backlog to work from.—**Joseph H. Melhado**, Acting Secretary, 24 Rodney Road, Scarsdale, N.Y. 10583

28

In our view, the chores and turmoil of a Christmas season are a modest price for the special pleasure and satisfaction of the many greetings from family, friends, and acquaintances. As we get along, such correspondence from classmates becomes particularly welcome and reassuring. This year, as usual, there were numerous cards and notes received by your local (Boston) group. Although the list is long (enough for a very respectable reunion) we would like to share it with

you and report some of the comments that were included:

Clara and "Arch" Archibald, Beryl and Elbridge Atwood, Iris Bassilio, Marjorie and Bill Bendz, Ruth and George Bernat, Ethel Bernhardt, Ruth and Chris Case, Jan and Jack Chamberlain, Marie and George Chatfield, Elmer Deane, Alice and Vic deCorte, Frannie and Jim Donovan, Helen and Roland Earle, Huyler Ellison, Olive and Newt Foster, Trudy and Don Francis, Martha and Don Fraser, Dorothy and Carney Goldberg, Sally and Bill Hall, Helen and Bob Harris, Irene and Ted Hartshorne, Anne and Walter Hildick, Asako and Shikao Ikehara, Florence Jope, Adrienne and Art Josephs, Caryl and Ben Kelsey, Louise and Ernie Knight, Kathleen and Bob Larson, Janet and Fred Lewis, Alice and Mieth (Slim) Maeser, Catherine and Paul Martini, Dora and Dave Mathoff, Marge and Frank McDermott, Bea and John Melcher, Frances and Carl Myers, Maxine and Karl Otte, Anne and George Palo, Mary and Max Parshall, Gladys and Bill Phillips, Ed Pitt, Virginia Rigby, Verna and Rudy Slayter, Pam and René Simard, Betty and Dud Smith, Walter Smith, Edward Stevens, Hirsch Sulkowitch, Dorothy and Herb Swartz, Ann and Will Tibbets, Velma and Charlie Worthen, Dorothy and Abe Woolf, Edith and Ray Wofford, Lillian and Gilbert Unverzagt. If there is any omission from the foregoing list we apologize and will welcome all corrections. Here are notes from the group:

Beryl, writing for the **Elbridge Atwoods**, reported that they would spend Christmas visiting with their daughter in Sewickley, Pa. In October Beryl visited their son David in Switzerland, and stopped off for a few days in London. Elbridge was too busy at the time to make the trip to Europe. . . . **Ethel Bernhardt** enjoyed a three month stay in Tucson, Ariz. last spring. She always reads the '28 notes with great interest. . . . **Huy Ellison** had the misfortune to fall and break a rib just prior to Christmas. It was a painful experience and delayed his mailing program now, but he seems to be all right somewhat.

Don Fraser sent in a brief but hearty note. He is still busy at Gulf Oil head-

quarters involved in overseas technical marketing matters. Don envies those classmates now retired, but with a daughter still in college, feels he must keep going. He is looking forward with hope to the 70s and glad to see the disastrous tax-laden 60s behind him. The **Shikao Ikeharas** spoke of recent visits to Japan by Marjorie and **John Carvalho** and by Louise and **Ernie Knight**. Shikao has fond memories of the 40th reunion and hopes to see classmates in his country for the 1970 exposition.

Florence Jope still turns out a cheerful greeting card expressing the family activities and sentiments in poetry. Son Ted graduated from Cornell in 1968 with a B.S. in Industrial Engineering and Operations Research. He has taken graduate courses at Cornell since then. In March he expects to enter Officer Candidate School at Newport which will lead to a Navy commission as Ensign in July. Then he will serve three years in active duty. Ultimately Ted has his sights set for an M.B.A. from business school.

Louise and **Ernie Knight** live in the wilds of Maine. Last year they took a twelve-week trip to the Orient by combination of ocean freighter and air travel. We mentioned this in earlier notes and hope to report more fully in a later issue. It was a memorable year for the Knights. . . . **Slim Maeser** retired on December 15 last and, with Alice, is looking forward to spending some time in Florida early in the new year. Their daughter Doris is teaching at Montclair. . . . **Dave Mathoff** has been obliged to suspend all his activities while he recovers from two recent heart attacks. He was hospitalized twice within three months but is home now recuperating. Dave, we all wish you a speedy return to good health. . . . **Johnny Melcher** appears to be hard at work and stated he was still very busy with Leeds and Northrup. . . . Anne and **George Palo**, planning new travels in 1970, expected to be in California in January and London in the summer. They are sure, however, that any plans for 1973 will have to take second place to the 45th reunion.

Mary and **Max Parshall**, who moved recently to Hamilton, Mont., are enjoying their new location and describe it as beautiful, peaceful, quiet and with fine neighbors. Good trout fishing is only two blocks away and steelhead fishing 2½ hours away on the Salmon River. It is 50 miles to Missoula and Montana State University where the Parshalls can go to concerts. Mary has piano students two days a week and does church work in addition. . . . **Bill Phillips** reports that he is now business manager for Curtis and Davis, and architectural firm. Bill saw **Jim Donovan** recently at the Chemical Industries Show in New York. . . . **Virginia Rigby**, in a formalized Christmas letter, gave a beautiful account of her travels last summer which included three weeks in England followed by a month in Africa. She covered a great deal of African territory in that short time, yet managed to visit in detail some very exciting places

and study the people. Pam and **René Simard** have finally attained the status of grandparents. A daughter was born on December 1 to their oldest son, Guy. . . . Verna and **Rudy Slayter** are having the joy of watching their granddaughter Elsbeth as she grows from infancy into a little person. Rudy attends meetings of the Alumni Advisory Council quite faithfully. . . . **Hirsh Sulkowitch** stated that he is now going on his third year as Clinical Professor of Medicine at Temple University School of Medicine.

Betty and **Dud Smith** are yet another traveling team. Theirs was a 31-day, 30,000 mile trip to South America that started in mid-February of last year. They braved a heavy rainstorm to visit Machu Picchu, "The Lost City of the Incas" in Peru. Apparently they had better weather luck for the rest of the trip and saw almost everything from Panamanian jungles to the top of Sugar Loaf Mountain in Rio de Janeiro. The travel account was written in a letter too long to be included at this time. Here too, we hope to present more of the letter in later notes.

C. Rogers McCullough, an outstanding contributor in the field of nuclear power technology, died in Washington on January 13, 1970 after suffering a heart attack. In 1922 Dr. McCullough received his S.M. and in 1928 his Ph.D., both in chemistry. He most recently held the position of technical director and board chairman of Southern Nuclear Engineering, Inc. of Bethesda, Md. and Dunedin, Fla. Throughout his career he served as president and chairman of various national scientific societies. He served as scientific advisor to the U.S. delegation to the United Nations International Conference on the Peaceful Uses of Atomic Energy in 1955 and 1958. He was the author of numerous articles and held 16 patents; his awards include the Presidential Certificate of Merit. Dr. McCullough is survived by his wife Exia, a son David of Boston, and a daughter Diane Agramonte of Rockville. To them we extend the sincere sympathy of the Class.

In several cases appreciation was expressed for the class listing with current addresses that was mailed out in December.—**Walter J. Smith**, Secretary, 209 Waverly Street, Arlington, Mass. 02174

29

I regret to announce the death of **John R. Ford** on September 1, 1969.

A note from **Adrian N. Clark** of Woodbury, Conn. states that he is 95 per cent retired. He is doing a little consulting work, and playing golf as much as possible. . . . **George J. Burke** of Salem, Mass. has joined E.M.R.-Computer as eastern regional sales manager. George will be responsible for sales activities in the eastern area, through the company's district offices in Boston, New

York, Philadelphia, Pittsburgh and Washington, D.C. He will be headquartered in Washington. Before joining E.M.R.-Computer, George was director of marketing for Autotech, Inc. He has also served as district manager for Systems Engineering Laboratories and sales engineer for Computer Control Company.

Charles J. Custer of Andover, Mass. recently celebrated his 40th anniversary of service with Bell Telephone Laboratories. After joining Bell Laboratories in 1929, Charles became engaged in the development of aircraft radio receivers. During World War II, he worked on a radio fuse project for Naval use and on radar equipment. He later turned to the development of a pilot regulator for the L3 Coaxial cable system. He also was concerned with measuring equipment for the first transatlantic cable project. For the past 14 years he has been involved in the development of microwave radio relay systems. Currently, he is working on a medium haul, microwave radio system.

A Certificate of Appreciation was awarded to **W. Gordon Bowie** by the Alumni Association for his outstanding work as Chairman of our 40th Reunion Gift Committee. . . . News has been received that **J. Russell Clark** of Dallas, Texas, vice president and general manager of LTV Aerospace Corp. (Vought Aeronautics Division) and company director, has been elected a senior vice president of the Corporation. . . . In my October/November class notes I inadvertently listed among the many hobbies and interests of **Fred Celler**, that of wine consultant for S.S. Pierce Co. of Boston. I received a letter of correction from Fred as follows: "It is with some amusement that I read our class notes in the *Review*, in which you turn back the calendar for me to the pre-World War II days. My current occupation is as per this note president of AMP de France. Perhaps others should know to avoid a boycott of good old S.S. Pierce! Otherwise congratulations on your first notes—they are most interesting. Sincerely, Fred."

A brief note comes from **Morris Smith** of Los Angeles, Calif., saying, "Spent three weeks this year (1969) on a trip to Israel which I enjoyed tremendously. At present, I am engaged as an electromagnetic compatibility engineer for Apollo Applications, the next step after Apollo. Some people consider this witchcraft; at times I agree. It gives me a chance to see all aspects of the Apollo program." . . . **Ridley McDaniel** of Planesville, Ohio, writes, "After almost 37 years of service, mostly on sodium silicates, I retired from Diamond Shamrock Corp., having reached the retirement age of 65. However, a month later I started to work again for Diamond as a consultant and continued through May. Since then, I have done occasional consulting on sodium silicates for other concerns." . . . Words of greetings come from **Everett F. Kelley** of Melrose, Mass., saying, "Hello to all my classmates. Ex-

pect to retire shortly and try to enjoy life. Have traveled extensively last two years as part of I.T.T. Lamp Division, but never seem to run into any of my old classmates."

A note comes from **Vahram G. Miskjian** of College Park, Md. as follows: "I have been forced to retire because 65 years old. Because of age discrimination and the Vietnam War, I have been unable to find regular employment yet. You fellows should have some sort of arrangement for guys like me so that we can contribute (to the Alumni Fund) the minimum amount. I would like to stress the fact that my desire to give to M.I.T. has not changed."

John Ade Plugge of Chevy Chase, Md. writes, "In mid-May, I had a nice phone call from **Takanao Kuki** of Tokyo, Japan from New Jersey, but he was unable to get down here to visit us on this trip. We first met at a boy's camp in the Adirondacks in 1923. His bright and beautiful daughter got her B.S. degree from Muhlenberg College a year ago and Elenor and I drove up to Allentown, Pa. for the happy day. The last three summers, we have gone to San Francisco to visit our elder son, Jim, his wife Barbara and our three grandchildren. In 1966 we also went on to Honolulu to visit an old friend for several weeks. We also have had some nice side trips to Yosemite, Santa Barbara, Hearst's Castle, Crater Lake, and Mt. Lassen National Park. Had a real nice surprise one evening while visiting Chinatown in San Francisco; we were in the largest store on Grant Ave. and found out that the boss had graduated from M.I.T. from my old course (IV-A)."

Since many of our classmates have had distinguished careers with the Telephone Company, it comes as little surprise that **Edwin H. Perkins** of Ipswich, Mass., also celebrated his 40th year of service with the Bell Telephone Laboratories in Andover, Mass. Since 1929, Edwin has been engaged in the development of transmission system components and circuits. For many years he was concerned with the theory and development of feedback amplifiers and regulating circuits for telephone wire and cable systems. In 1948 he designed the repeater for Type N Carrier System, which is still a major link in the intercity telephone complex. In 1955 he was transferred to the newly formed Merrimack Valley Bell Telephone Laboratory and was placed in charge of the development of the Type P Carrier System for rural areas. He currently is responsible for the design of N2 Repeaters and for coordination of Type N Carrier Systems in the field. He holds three patents. Edwin and his wife Ruth have lived in the Andover area for the past 13 years. They have two children, Edwina and Ralph.

James C. Reddig of Webster, N.Y. is currently engineering supervisor for Eastman Kodak Co. In his biographical sketch, he writes, "Airplane design 1929-39 with Loeing, Fleetwings, Edo,

Kirkham and Kenyon. Two of my five 1936 Fleetwings 'Seabird' stainless steel amphibians are still flying. Private pilot since 1929, an avocation. From 1939 to date with Eastman Kodak; 30 years straight time plus another 10 years in overtime, chiefly on aeronautical associated work; now into the space age with Lunar Orbiter. But I'm drowning in paperwork, and I am appalled by my incoming engineers who can do wonders in programming computers, but have little feel for the hardware of engineering design. I treasure my M.I.T. inheritance, where we got our hands dirty." Jim and Geraldine were married in 1933 and have three children and four grandchildren. Among his hobbies he lists flying and a big home shop for do-it-yourself tinkering.

I have just received a letter from **Levon Seron** of Joliet, Ill., bearing the tragic news of the death of his wife. His letter follows: "Dear Karnig, It is indeed with a heavy and sorrowful heart that I must inform you of the sudden passing of my beloved wife Nasalee, this January 11. The hurt has been greatly eased by the presence the past few days of our lovely daughters, Evonne and Arie and our five wonderful grandchildren. We have read the many glowing reports of the 40th reunion, and on many occasions spoke of our regret at not being able to attend same. My wish for your good health. Sincerely, Levon."

A. L. Bruneau, Jr., '38, a member of M.I.T. Alumni Day Committee, in charge of the Arthur Fiedler Pops concert program would like us to know that Symphony Hall is reserved for us Sunday, June 14. Reservations are now being taken and choice locations on the floor of the Hall will be assigned on the basis of first come-first serve. Even though preference is given to the reunion classes of 25, 40 and 50 years, there are many tables available on the floor for those who respond first. If you would like to attend, please send your reservations to me as soon as possible to insure getting good locations. Please do not send any money with your reservation. Will let you know when and how to get your tickets.

Would like to hear from more of you fellows, even a brief note of greetings and latest job status and other interesting news items. With kindest regards to you all, and wishing you good health.—**Karnig S. Dinjian**, Secretary, 32 Oldham Rd., Arlington, Mass. 02174

30

The "News for my class secretary" portions of the Alumni Fund envelopes are now coming in at a gratifying rate bringing me usually very brief, but always welcome, news items about the donors. Most of them this month came from retirees. . . . **Alvah (Perk) Perkins** retired in December 1969 after 34 years in government service, mostly military. He reports "no major accomplishments

and no regrets. It was a wonderful sleigh ride." . . . **Jean Kresser** retired from Westinghouse Electric Corp. in October 1969 after 34 years of service. However, he plans to continue doing consulting work on power systems. . . . **Graham Walton** retired on February 1, 1970 after 27 years of service as a commissioned officer in the U.S. Public Health Service. . . . **Frank Hankins'** retirement from Lockheed was reported in the February 1968 Notes. He has apparently been doing some traveling because he says he recently spent a delightful evening with Air Marshall **Perm Limpisvasti** in Bangkok. Perm has also retired after 10 years as managing director of Thai Airways. According to Frank, "he looks about 40!" . . . **Chuck Twelves** failed to say when he retired or what he retired from. However, the 1967 Alumni Register indicates that as of that date he was assistant vice president-engineering of the Pacific N.W. Bell Telephone Co. The Twelves live in Walnut Creek, Calif. and have two daughters.

Supplementing the report in the March 1969 Notes concerning **Haskell Small's** manifold activities, he will become president of U.S.O. in April of this year. He is a member of the board of managers of the Washington Hebrew Congregation and Treasurer and a member of the Board of Governors of the Arts Club of Washington. . . . **Fred Turnbull** is practicing patent law in Washington. He lists as his hobby "grumbling about high taxes and unconstitutional infringement of all sectors of our Nation by demagogues." . . . **Allen Latham** has moved up from president to chairman of the board of Cryogenic Technology, Inc. . . . **Carl Vanderwarker** is vice president and general manager—eastern region of American Mutual Insurance Group. The Vanderwarkers live in New Canaan, Conn. and have two sons: Carleton, Jr., who went to Andover, Yale and N.Y.U. and is a film producer and Peter who is in his 5th year in architecture at the University of California, Berkeley. Carl is a member of the Union League Club of New York, the Country Club of New Canaan, the Advisory Board of Directors of the County Trust Co. in White Plains, a member of the Corporation of Babson College in Wellesley and a director of the Greater New York Safety Council and the New Canaan United Fund. He is also a candidate for town political office, but doesn't say what office.

As of this writing, the first mailing on the 40th reunion arrived about 10 days ago. Upon checking with Ed Kingsley, I find that the following have already indicated that they will attend: Abbott, Barker, Bates, Bridge, Chapman, Elizabeth Everett, Fahnestock, Ferguson, Harrington, Hartford, Herbert, Holt, Hulett, Kresser, Kingsley, Latham, Martel, Mastrangelo, Moriarty, Nolan, Phillips, Reisner, Ross, Schildknecht, Scott, Charles Smith, Myron Smith, Wedemeyer and Wye, most of whom will be bringing their wives. If you are planning to come and have not yet signed up, it

would be well to make your reservations promptly.—**Gordon K. Lister**, Secretary, 530 Fifth Ave., New York, N.Y. 10036

31

If you have an opportunity to read **Dick Lankes'** article, "The Role of Optics in the Apollo Program" which appeared in the September/October 1969 issue of *Optical Spectra*, don't miss it. . . . A note from **Emile Grenier** tells that he is with the Ford Motor Co. Automotive Safety Research Office. Emile was responsible for the Ford Tot Guard Design child restraint device which was put on the market late in 1967 and represents the "maximum life insurance possible for a child riding in a car."

Frank Weeks writes that he and his wife continue to spend their vacations in foreign travel. In 1969, they took a cruise of the University Club of Chicago to the Leeward and Windward Islands as well as a trip to Jamaica in December. Morocco, they hope, will be next. . . . **Art Fuller** reports having a heart attack last summer. All his classmates hope he has completely recovered by now. . . . After 30 years with the federal government, **Gabriel Cristofalo** has retired from his position as Chief-Airports Engineering Branch of the Federal Aviation Agency. He will be spending the winters in Florida and summers at Rockaway Beach, N.Y.

Victor Duplin, Jr. also reports his retirement from Babcock and Wilcox Nuclear Plant. Victor is farming, raising Angus and still active on the M.I.T. Educational Committee. . . . **Bob McKenzie** says he is semi-retired and does a little construction estimating at home. He and his wife, Jeannette, recently returned from a trip to Hawaii which they thoroughly enjoyed.

With regret, I report the death of **Bill Stellrecht's** wife, Elisabeth, on October 20, 1969. The Class of 1931 extends its deepest sympathy to Bill and his family. . . . Classmates whose deaths have been reported since your last class notes are: **Harry R. O. MacNevin** on January 28, 1969; **Lincoln S. Gifford** on March 14, 1969; **Tigris H. Kazandjian** on July 26, 1969 and **Harold Alcaide** on September 10, 1969. This is the saddest part of a Class Secretary's job.—**Edwin S. Worden**, Secretary, 35 Minute Man Hill, Westport, Conn. 06880

32

On the first of February Ed Nealand had applications for the reunion in Spain from the following classmates and wives: Donald Brookfield, Ted Jones, Manley St. Dennis, Bob Strong, Bob Minot, Art Marshall, John Such, Fred Green, Jim Smith, George Muller, Bruno Werra, Lou Vassalotti, Alex Crosman, John Robinson, Carl Wahlstrom, John Finerty, Bill Pearce, Russ Robinson, Bob Prescott, Art Russell, Bill Hayes, Don

Gilman, Tom Sears, John Flatly, John Kelton, Harry Moore, and of course Ed Nealand.

The following items on pending mergers and acquisitions should be designated rumors until I obtain first hand information: Sante Fe Industries, Inc., a holding company set up by the Sante Fe Railway a year ago, has indicated an interest to acquire Dresser Industries. **John Lawrence**, Dresser's Chairman, would be named president and chief executive of Santa Fe Industries when the merger is approved. . . . E. I. duPont has agreed to purchase Endo Laboratories, a drug business with specialized marketing know-how. **Charles B. McCoy**, President of duPont, announced this acquisition, the first by duPont in 24 years. . . . The Wyandotte Chemical Company has received a tender offer from the German Chemical firm, Badische Anilin and Soda-Fabrik (BASF). **Robert B. Semple** will continue as President of Wyandotte after the acquisition.

John Zouck has been a gentleman farmer for some years with corn a principal crop. He also keeps a few horses and can hunt on his own place in Glyndon, Md. . . . Colonel **Artur La Capria** of Laurel, Md., our accomplished big game hunter, bagged a polar bear to add to his trophies; this was in Alaska at Point Hope north of the Arctic Circle. . . . **Henry Worcester, Jr.**, who still runs a string of fifteen laundry and dry cleaning plants around Annapolis, Md., also maintains a stable of horses which he races at Maryland tracks. . . . Colonel **William Glowa** is the Maryland vice president of the Armed Services Communications and Electronics Association which holds meetings at many plants along the eastern seaboard. Bill is the not-so-retired Air Force officer who is a Civil Service engineer at Fort Meade, Md. and lives in Ellicott City, Md.

Dr. Samuel E. Paul has left a medical practice in a New Hampshire town after 29 years of complete involvement in the life of a small community to become staff physician at Camarillo State Hospital in California. He started in a mental illness unit, is now working in a unit for the mentally retarded and plans to start psychiatric residency in July. . . . **Robert Loeb**, formerly with the Martin Co. in Baltimore, is now retired in Luther-ville, Md. He and his wife, who have a daughter in college, travel extensively in their camper. . . . Professor **Herbert Neustadt**, who graduated in physics, is teaching electronics at the U.S. Naval Academy. He lives with his wife and three children in Annapolis, Md. . . . **Howard Lenderking** is an industrial engineer and has been with duPont for 30 years, at present in the nylon plant. He and his wife live in Martinsville, Va. and since all their children are married, they like to travel.

C. Vance Hale is with Noland Plumbing and Heating Co., a firm serving the southeast. His favorite sport is still golf, and he invites any classmates visiting

the Newport News, Va. area to be sure to call him. . . . **Reginald R. Lundstrom**, who graduated in aeronautical engineering, is with N.A.S.A. at Langley Air Force Base, Va. He is an ardent sports fan and still plays a smashing tennis game. . . . Professor **Jacob Millman**, Columbia University, has been awarded the 1970 Educational Award by the Institute of Electrical and Electronic Engineers for "his impact in the areas of electronic devices and circuits through his outstanding textbooks and stimulating teaching." . . . Reverend **George R. MacClintock**, who graduated in civil engineering, is now pastor of The Church of the Epiphany in Danville, Va. Originally from Massachusetts he is now as much a southern Virginian as the tobacco growers in his area. He and his wife have two children and he is an ardent stamp collector. George is one of the two ordained ministers in our class. . . . **Christian E. Grosser**, who graduated in mechanical engineering, has his own private practice in machine design in Richmond, Va. He and his wife have five children, only one still at home in college.

J. Marvin Watson had the misfortune to lose his wife in December 1969. He is with the Richmond Headquarters of the Life Insurance Co. of Virginia and lives in Ashland, Va. . . . We have notice from the Alumni Office of the death on September 5, 1969 of **Maurice M. O'Brien** of Cleveland, Ohio. A brother has written us of the death of **Jose Carlos Barousse** who died suddenly March 30, 1969, in Mexico.—**Elwood W. Schafer**, Secretary, Room 13-2145, M.I.T., Cambridge, Mass. 02139; **James Harper**, Assistant Secretary, 2700 So. Grant St., Arlington, Va. 22202

33

The material shortage this month is chargeable to the many members of the class who do not, and in many cases, never have, turned in material for class news. The presentation of the material is the job of the Secretary, and even this is divided up into two parts, the willingness to present (a verb), and the amount available. Every reader who sees this tome can judge for himself just what he did or did not do to make the April news successful, or, in this case, partially successful.

We are heartened no end to have a new contributor in **Thomas (Tom) Chadwick** who writes that his conscience will be eased by dropping me a line complimenting me on the "splendid" class letter dated August 31. Gee, Tom, too few thought so, so I love your admission. Tom's note follows his contribution to the Alumni Fund (sezzee), and that is admirable. Tom's one-and-one-half years in Cambridge allow him to "recognize a lot of names, but no faces!" He has kept close touch with Institute affairs through Phi Beta Epsilon, his fraternity at Tech. I am forced to admit that one may keep in touch through a fraternity, but also submit that it is easier, and

much more informative, if done through the *Review* and the Alumni Association. But we cannot complain; after all, Tom did write, which makes him almost unique (this month). Tom says that he sold his bleaching and dyeing business in 1968, and thereby found himself deep in country banking. Tom and Betty live in Newburgh, N.Y. and have two children, both about half way through college. Tom agrees that Betty is much more civic minded than he is, being very active in hospital work, and also in the local, and Garden Clubs of America. Betty must have lived in Exeter as her Dad was, for many years, treasurer of the Society of the Cincinnati; its headquarters are in his home in Exeter. I solicit advice or corrections when I say that this society is a latter day haven for descendants of Commissioned Officers of the American Revolutionary army. Tom, I really appreciate getting your note. Many thanks, and best to Betty and all the little (?) Chadwicks.

I have a very short one from **Cal Mohr**, too much so for him. Cal is sorry that he missed me at the Alumni Officers' Conference, which makes it unanimous. He says that he did see one of his old professors, Dr. Avery Ashdown, who in 1933 was Professor of Organic Chemistry. The good Professor is retired, but still has an office, and still has his daily swim at M.I.T. Cal had little time for the Conference, as he had fixed it to see an old uncle in Lebanon, N.H. and did so after some trying weather complications, airwise. Thanks, Cal, and I hope that I am forgiven for not calling you more than once while at the Livestock Show in early December (24 hours only, for me this time).

Several have remarked on the (earlier) treatment of the **Dick Morse** story as it appeared in *Innovation*, but **Ralph Cross** comes through with a request for more info on the magazine itself. Inasmuch as I have nothing on the magazine, I suggested that Ralph get in touch with Dick, who surely ought to have *Innovation* at his finger tips.

Way, way earlier, **Beau Whitton**, our Foreign Office man from the deep south, wrote us that he and Daphne were about to leave on a air trip to Kenya, but not for the usual reason. They intended to see the East Africa scene as tourists, and, they were also to see and visit with their daughter who was then attending the University of Kenya, on leave from Duke where she was and is a senior. Golly, Beau is surely the man of the hour; I don't know how long the little girl attended the University there, but Beau just made it before she left for home, and Duke, at Christmas time. "Had a wonderful trip; saw the lions and the other usual fauna, but like the U.S. best of all." Beau is a man of few words, obviously, as he gets by many kinds of strange beasts as "other usual fauna." Well, I can't complain about Beau, as he is one of the faithful. Beau goes on, very briefly, to say that son Robert is teaching in Philadelphia at the University of

Pennsylvania, and has just passed the orals for his doctorate in mathematics: "Much elation in the Whitton Household." Eldest daughter, Margaret is married and living in Charlotte, N.C. It appears that Margaret's young husband is a lawyer graduate, and is combining this with politics. Well, that is far from an innovation, huh? For your further information, Beau is still very active in the family business, the Southeastern Construction Company of Charlotte, and said company operates over a large area of the mid-south, as far as Tennessee. Many, many thanks, Beau, and I am awaiting the time with impatience when you and Daphne become grandparents, or are you now? Please let me know, as it will save me scanning former issues of the *Review*. Heading the address changes are those from whom we never hear at all; **John G. Hayes** of California and Dr. **Almon Parker** of New Jersey. Any of you readers who know either of these, well, would do all other classmates a favor were you to write or see these characters, and suggest that they contact me by mail.

Among those from who we do hear, and whose address is changed are: **Leon Hyzen**, AR(IV); **William W. Pleasants**, CE(I); and **Tom Fitzpatrick**, also IV. Tommy Fitz, please send in the full address, and, the Zip Code number! Incidentally, my cards show that we have Zip numbers from about 60 per cent of the Class, indicating that we do get Zip numbers even from those who will send us nothing else. We have heard from less than half the Class in these last 7 years. Some fine day I am going to publish a list of those who have contacted me by any means, just to see if I can't start a controversy—which always stimulates circulation.

Now comes, from Virginia, the annual Christmas family letter of the **Horace MacKechnies**, he of the Department of Defense, in the office dedicated to saving money for the department. They must make the saving, as Horace is still there, and still hard at it. It seems that Horace, last spring, did a landscaping job on the back yard, making a Hemlock hedge, and curving gardens. But, 'lil ole Prue seems to be the supervisor as she is the Mac that belongs to the garden clubs, and is an officer in one. The Macs visited Charlottesville to attend younger daughter Joan's graduation from nursing school, and the sorority banquet. They went with Joan on a five day trip to Sky Lodge, as a respite before Joan went on to Chapel Hill Memorial Hospital, to take her first job. These Macs are surely travelers as they got in trips to Williamsburg, had a cottage at Virginia Sea Shore Park, did a short stint at Otter Lodge in the Blue Ridge, and, visited Wilson's birthplace in Staunton (rhymes with Scranton). It seems that Horace is very active in church affairs as is Prue. Horace is deacon and he is president of the Civic Association. Horace and Prue visit New Jersey quite often, as elder daughter, Margaret, lives there. To add greatly

to their pleasure, their grandchildren made a long visit in the summer. Horace and Prue, you are just fine folks to remember us with your family letter. I think, personally, that it is a great idea, as it must perforce take the place of hundreds of cards. So, many thanks, and a late Happy New Year.

Bill Bauer, of Media, Pa., sends us a clipping from the local paper containing an article written about **James E. (Jim) Norcross**. Jim, on December 3, received a well deserved award from the National Electric Manufacturers Association. The award was the Association's Community Service Award, a bronze medal and a citation for 20 years of Service with the Visually Handicapped, a volunteer group. Jim joined the board of directors of this group now known as The Working Blind, Pennsylvania's largest agency in this kind of work. In addition to all this, Jim is chairman of the Business Opportunity Committee of the Working Blind, which trains the blind and then helps find them jobs. Further, Jim is a member of the Special Redevelopment and Property Committee, engaged in making into a reality a new Center for the Blind; a multi-purpose center which will provide services to the blind of the Lower Delaware River Valley. We offer our sincere thanks to Bill Bauer for sending in the clipping, and our congratulations to Jim Norcross for his having been recognized for his more than worthy civic work. Jim, we appreciate your modesty, and so depend on Bauer. Why not drop us a line soon, and corroborate all this above?

As for **Bill Bauer**, his Christmas card carried a short message from him and Clare. Perhaps you will recall that Clare had a bit of bad luck, while visiting Italy, earlier this year, and broke two bones in one leg. This forced them to cancel the remainder of what might have been quite an extensive trip. Now, Bill says that Clare is 100 per cent over her disability and that they are preparing to visit Florida again, with the idea of finding a permanent location there. Bill, you are one of God's gentlemen, and are awfully nice to send me the Norcross clip. Many thanks, and we will look forward to seeing you in Florida, perhaps for longer stretches than a plain exploratory visit.

Again we have a fine Christmas letter from Jermain and **Jack Andrews**, of Lawrenceville, N.J., and it is surely welcome. A more active family might be real hard to find; son Johnnie is in his second year at the University of Colorado—after spending a summer selling dictionaries from door to door. He is taking an informal course in home economics, as he and three pals have hired a whole house in which to live; that is, eat, sleep, and study. Daughter Valerie finished her sophomore year at Beaver College, then took off for an art course in Florence, Italy. At summer's end, she went to England to start her junior year in Beaver's London program and in January returned to Beaver to finish the junior year. Daughter Jamie is in her

senior year at Wheelock School, but spends her summers in Florida working. Gwen returned from Spain after a year there and in Italy, though she spent most of her time in Barcelona, and took a semester in the University of Barcelona. Gwen is a secretary (a graduate of Katherine Gibbs) and is presently doing secretarial work, probably with a recoup of the exchequer in mind. Gail has left the Mass. General Hospital, and thereby deprived the hospital of one of its best nurses. She intends to take a French course at Lausanne, visit with her sister Valerie in London, and spend the remainder of the year in Europe. Jermain is still teaching and tutoring, still on the board of the Princeton Skating Club, grows a lot of lovely flowers in her garden, and, to keep busy, she does a lot of her own dressmaking. Jack is board chairman of his church, and is chairman of the Highway Research Board, Department of Maintenance, in Washington. Within the year the Andrews have done some skiing, mountain climbing, concert and play attending in Princeton, and now have joined the Friends of the Princeton University Art Museum. Jack and Germain, we all thank you for remembering us at Christmas time, and we always look forward to your nice letter.

Wonders will probably never cease. Just when I thought that I was out of class news material, I got a one pound package of press clips from the Alumni office, and, did I ever need it. The shipment included a few of those remarkable Alumni Fund Capsules, addressed to the Secretary. First we have **Dayton Clewell** who says that the ship Jean christened last August was the *Mobilita*. Earlier, we mentioned that Dayt and Jean were taking off for Japan for just the above purpose, among other things like ten days travel in Japan. Thanks, Dayt, and a little longer treatise next time would be appreciated. Jean, thanks for your fine note earlier, and you, too, may write again if you find yourself so inclined.

Samuel Lieben comes through with a short, terse, biographical paragraph, in list form: director of 1) Metex Corp., 2) Atar Computer Systems, Inc., 3) Talon Adhesives, Inc. Further, he is a partner in the Broadway Tire and Rubber Co. It occurs to me that Sam left out something, so as he reads this, he can sit down and make the correction via the mails, direct. Thanks, Sam, and you may write any time, with the above stated admonition. **William W. (Bill) Pleasants** fills us in on the "why" of the address change, mentioned above. Bill has made his way back to Puerto Rico, as resident field manager of Squibb International Engineering, and is building a new pharmaceutical plant near Humacao, P.R. Now, Bill, with all this favorable publicity, why not write in more detail about this interesting change. Your stay along the Delaware was less than a full year, was it not? Anyway, our sincere thanks, Bill, and from us all. Another short one, terse, and to the point, from **John Trump**, electrical engineer extra ordinary, who says he spent the

years 1967 and 1968 in Berlin, working for AEG (Allemeine Elektricitats Gesellschaft) in their (in English) "Automation of Industrial Processes." Thanks, John.

We are indebted to Colonel James E. Harper, U.S. Army, Retired, and of our Class of 1932. He encloses a note from **Niazi (Musty) Mostafa** of Cairo, Egypt. Colonel Jim, we thank you, but must suggest that Musty, for some reason or other, wrote me this time, and the story appeared in this column, probably January or February. Thanks again, Jim, and if you hear further from this character we would appreciate receiving it.

A release from the A.I.A.A. about its annual meeting last October announced that our own brilliant classmate, **Ivan A. Getting**, President of Aerospace, presented a feature paper. Ivan, may we have a short resume of the paper?

We are somewhat disappointed to find that **Lewis W. (Bill) Moore**, retired from his service with American Oil Co. March 1, 1970. Though I have never heard from Bill directly, he has been a real source of news for many years, and I for one will miss him. I have never had anything, directly, on what Bill has been doing for recreation, and pleasure, and perhaps exercise, all these years, though it has been rumored that he is quite a sailor, and belongs to a North Shore, Chicago, yacht club. I have nothing else. Bill, you will read this column early in April, and I, speaking for the Class, would really enjoy getting a rundown on your recreation and pleasure activities. Your reply surely ought to reach the stands before the end of this fiscal, or academic year. Further, Sir, we all are interested in what you intend to do in your retirement, as it is difficult to imagine you doing nothing.

Now comes **Richard S. Morse** with another interesting story. Golly, if there is anyone in the Class more irrepressible than Don Fink, it must be this fella Morse. This new story appeared in the *Boston Globe*. It is not surprising that Dick is interested in automotive steam engines, as his work in air pollution precedes the work in steam propulsion. Dick's new company is called Steam Engine Systems, Inc., of Newton, and the company went public during the summer, when they raised \$300,000, and the issue was oversubscribed. Do you folks recall "with your money and my brains"? Dick says that they have a top notch technical team working on this steam engine project; he does not talk about steam engines for automobiles alone, and stresses the fact that the application is headed for a much wider field, or fields; namely, boats, buses, materials handling, earth moving equipment, off the road vehicles, and auxiliary power units. Well, say I, why not, though the automobile potential is the equal, or almost, of the rest combined. We have little space here for discussing the problems which hamper the application of the steam engine, but a few radical solutions have arisen. Among these are the use of

fluids other than water, an idea which is, apparently, new. One major item which is always with us is the cost "hang up," cost of manufacture, particularly. But, says Dick, steam is quite attractive with its low start and stop operation, higher torque at the lower engine speeds, lower requirements for gear reduction, lower cost of fuel, less noise, and, much reduced pollution. Dick says that next year should bring, for Steam Engine Systems, Inc. a working model of a fairly large 50-60 H.P. engine, and "we have designs, and are working on them, for engines in the 200-250 H.P. range."

Among Alumni Fund Certificate recipients we find **Dayton H. Clewell**, Chairman of the New York area Special Gifts Committee. I may be in error, but it seems that these certificates are awarded annually by the Alumni Fund to alumni whose performance on behalf of the Fund has been outstanding. Our good Executive Vice President is outstanding anyway, so made it with ease. In a rather large group, Dayt is the only 1933 man so honored. We offer you, Dayt, our most sincere congratulations for having received this honor.

Edward R. Atkinson of the Arthur D. Little Co. of Cambridge, with one A. J. Puttick, has a paper to his credit, "The New Antimalarial Drugs and Quinolinemethanols," prepared for the U.S. Army. It appears that the title is, to some, self explanatory, and I will send my version to anyone who asks but suggest that Ed Atkinson be contacted if any solid explanation is needed. Ed, this looks profound, and, as such, we salute you, with our very best wishes.

Here is how inquiries about address changes pay off. **Newton W. Buerger**, formerly of Tahoe, Calif., now is located, but temporarily, at the Buergers' Pebble Beach house. At Tahoe, Newt, was chief metallurgist for Viking Metallurgical. This company was purchased by Air Reduction recently, so a change was surely indicated as Newt says that his two-day week blossomed into a five-day week, which was not part of the original bargain. This, plus too danged much snow at Tahoe clinched the matter. Newt and his lovely are back at Pebble Beach and are trying real hard to sell that house. In the meantime, they have purchased another house in Orange County, right on another golf course at Mission Viejo. (I must look that up.) This fella seems to like living on golf courses, but the records show that he doesn't play golf. Hence he must be my type of golfer: watch others play. However, I do drive out several hundred balls a week to keep loose. Newt's hobby used to be the actual building of houses; now he just buys them. Newt allows that he is looking forward to getting back to consulting (on a two-day-per-week basis). He modestly admits that he is one of the very few who understand fabrication, particularly Titanium and its various alloys. The real reason for the move to Mission Viejo is so that the Buergers can be near their children and grandchildren.

They have two children, both married, and each of them have two children. Chip is 35 and Brenda is 30. OK Newt, we do wish you luck selling the Pebble Beach house. Keep us posted on the new place in the southern county. **Leon Hyzen** lives in San Clemente, so if you get living in that corner of the county, he would love to have you make yourself known. Leon is a transplant, in architecture, from Chicago. Many thanks for the letter, Newt, and best to you and Esther Jane.

Yielding to popular demand, many requests, one or two anyway, are for something brief on Ye Scribe, a subject that has been purposefully and carefully avoided for some years. I have contended, via the mails, that the faithful are subjected to plenty from me, so that they won't need too much *about* me. One chap, nameless, says that I badger the class incessantly for class news, but never include anything on my own setup. That is not so. I tell about certain trips Leona and I take, or that I take alone. However, one other critic says, "Why not something about yourself, ya big ham?" Mr. Ham to you, ya lug! Much has happened since we sent the committee our stuff for *Goodridge 25*, and I suggest that you start there, as I will here. In 1958, we still lived and voted in Cleveland, even though we spent little time there. However, in 1960 we decided to sever all our Cleveland connections, including our membership on the Board of the Warner and Swasey Co. We took great pains to do a bang up job of severing, so that we might avoid the possibility of being taxed in possibly three states. Then, while deciding where we wished to establish our legal home for voting and tax purposes, it was apparent that New Hampshire was the place for such connections. But, you can't win (ask Emmy Norris). I am still in the Angus breeding business, but in just a very small way now. My tussle with I.R.S. in 1954 to 1959 was profitable, but nevertheless hard on the nerves, though I enjoyed the battle no end. And, they ate dirt to the extent that they settled for approximately six cents per dollar. I am still a member of the New England Angus Board, and have since refused to be President for the second time. I have been a delegate from New Hampshire to the annual meeting of the American Angus Association for 22 consecutive years, and will leave next Saturday for Chicago, to be same for the 23rd.

With the gradual dropping of Angus breeding I find time for more extra-curricular stuff, a lot of it on M.I.T. work. I am a member of the Alumni Advisory Council, and a Fellow of the M.I.T. Center of New York. Although a member of Ellis Littmann's Steering Committee for the 40th fund, I am not a member of that fund committee, so you fellas can speak freely, and without restraint. In addition to such writing as is required on this job, I do a page twice a year for our "Angus Topics", an occasional article for the *Angus Journal*, and even less often

an article for several other lesser publications.

Within a year, and at first singlehandedly, I organized a brand new New Hampshire Angus Association, and was immediately elected Secretary. The budding new group shows a lot of promise, if held under a bit of careful control. Strangely enough, and it causes me to wonder, I appear to be the only breeder of Angus cattle, and in fact, the only cattle breeder in our class. I do hope that I am wrong, and if I am could someone kindly bring me up to date? I belong to the group that registers around a million calves every year, so I am not personally unique.

One might wonder what is being done with the land that once supported 35 to 40 head of brood cows. Most of the land is in hay, and as time goes on, the hay gets no better, inasmuch as it is not fertilized. Hence its value as cattle and horse feed lessens. We have arrived at a solution; for two years we have planted on a whole lot of our pasture and hay land, a total of about 24,000 trees, mostly white spruce, but many red pine, and a few hundred black walnut. According to present records, white spruce is the only spruce that resists diseases common around us. Red pine is another which, so far, has been immune. Black walnut is still another, though deciduous, that is not a suspect. We are allowed only 200 of these each year as they are quite scarce. To conclude this immortal tome, a performance that will not again be repeated, and to prove that we are joiners, our list of clubs, et al, includes Knights Templar, Consistory 32, the Shrine, the Hundred Clubs of New Hampshire and Broward County, Fla., Honorary Alumnus of Nova University, and a member of its Gold Key Society. We are members of the Royal Palm Yacht and Country Club of Boca Raton, and of the Boca Raton Hotel and Club.

We belong to countless conservation organizations, being a Charter member of Ducks Unlimited. In New York City, we are a Fellow of the M.I.T. Center of New York, and in Cleveland, we still belong to the Union Club. Further, we are a long-time member of Les Amis d'Escoffier, La Serviette Au Cou. That's enough for now, and for all time. I prefer not to make up any such story as above, but perhaps I am entitled to the same consideration as all others get in the *Review*.

If you wish to send in your five year pledge, send it to Ellis, Jim Turner, or even to me. All of us are trustworthy.

This winds up the April news for the distinctive Class of 1933, and lo, there is only one '33, huh? I wish to thank, here, the increasing number of those faithfuls who send Leona and me Christmas cards, regularly. I do appreciate finding myself in your thoughts. Obviously, we cannot send out cards to the whole Class. That's it for now. Look again in the May *Review*.—**Warren J. Henderson**, Secretary, Drawer H, Exeter, N.H. 03833

34

We are sorry to have to report the passing of two more members of our Class. Of one, **Lorimer C. West**, we have only a brief notice from the Alumni Association of his death in Saratoga, Calif. on December 6, 1969.

Our second loss was **James E. Archer** who received his S.M. in chemical engineering practice with us. He had come to M.I.T. after receiving a B.S. in chemical engineering from Rice University. In 1938 he received a law degree from George Washington University and in 1939 joined the American Cyanamid Co. in Stamford, Conn. Mr. Archer was with them for 30 years, retiring in July 1969 as chief patent and trademark counsel. During his career he had been admitted to the bar in the District of Columbia and had been active in many patent law and trademark associations. We extend our sympathy to both Mrs. West and Mrs. Archer.

In a happier vein, we have several brief notes from Alumni Fund responses. From **Larry Stein**, whom we missed at reunion: "Very busy as chairman of Hingham School Committee. Wife Geraldine received her Master's of Education in June and is now a 'media specialist' at North Quincy High School." It takes real bravery to carry on in a job like that these days. . . . Dr. **Theodore Steinberg** writes from Fresno, Calif. that he is married; his son Joel graduated from M.I.T. in 1967 and is following father's footsteps by attending Stanford Medical School. His daughter Marcia is a sophomore at Stanford University. Dr. Steinberg himself is currently Secretary of the California Medical Association Section on Ophthalmology. . . . From Ronkoma, Long Island, N.Y., **William E. Dobbins** says, "In 1967 I resigned my position as Professor of Civil Engineering at New York University to help establish a new consulting engineering firm. I am presently a partner in the firm of Teetor-Dobbins at MacArthur Airport."

By checking the Alumni Register we find that the "teaching" **Jerry Raphael** refers to is the chairmanship of the Division of Structural Engineering and Mechanics at the University of California at Berkeley. He notes, "In between teaching I'm still working on large concrete dams—just finished two: Mossyrock and New Bullard's Bar, and am just getting started on Ross High Dam. And for you easterners—sailing every weekend, winter (?) and summer." From what we read in the yachting magazines, we understand San Francisco Bay can be as windy and gusty as campus demonstrators. But after 25 years of sailing we know what a blessed change the quiet afternoon's sail can be.

Two final notes raise more questions than they answer. From **Gerald Hudson** in Fort Myers, Fla., "No news is good news" and from **Harry Heiligenthal** in Butler, Pa., "It is a long road that does

not have a turn' and we sure are looking for it!" Come on, fellas, you can do better than that. Especially Harry. Tell us what the turn is you're looking for and maybe we can help you find it.—**Robert M. Franklin**, Secretary, Satucket Rd., Brewster, Mass. 02631

35

The balmy breezes of spring remind us that the 35th reunion at the Chatham Bars Inn is fast approaching. If you have not sent in your reservation, do it now!

Boyd B. Brownell, Vice President of General Motors Corporation and General Manager of its Electro-Motors Division, has just been elected to the Board of Trustees of Illinois Institute of Technology. Boyd went to GM straight from M.I.T. as a test engineer and designer for the Delco Products Division. Two years later he transferred to the Electro-Motors division where he held a number of progressively more important assignments until he was appointed to his present position in 1965. In addition, he has served on the Board of Directors of the West Suburban Y.M.C.A. at LaGrange, as past President of the Board of Trustees of the First Presbyterian Church, and as a member of the Board of Governors of the Community Memorial General Hospital. He is also a member of the Board of Directors of the Illinois Chamber of Commerce, the Citizens Traffic Safety Board of Chicago, the Community Fund of Chicago, and the Board of Regents of General Motors Institute.

George J. Platt was elected chairman of Paragon Electric Company, Two Rivers, Wisc., a subsidiary of American Machine & Foundry Co. . . . **Thomas W. Hafer** has transferred from Raytheon to ITT-Europe, 11 Boulevard de L'Empereur, Brussels, Belgium. . . . **William W. Cross** was elected group vice president for International Operations, Kimberly-Clark Corporation, Neenah, Wisc.

John S. Cort, Jr., who retired as manager of the Agricultural Chemical Division, Diamond Alkali Co., Cleveland, in 1968 reports that he manages to keep active. Right now he is a volunteer in a tutoring program at a junior high school. . . . **Lester A. Brooks** wrote a chatty note saying, "It was most interesting to read Ed Collins' colorful write-up of our golf game last summer, in the December issue of the *Review*. I was surprised to learn I had been promoted from director of research to vice president of research. Now I am really worried and am wondering if they are still hiring at the shipyards."

Professor **Walter H. Stockmayer** delivered a series of five lectures at the University of Utah titled "The Statistical Mechanics of Macromolecules." This past year he concluded assignments as a member of the National Research Council Advisory Panel of the National Bureau of Standards, and as a member of the

Visiting Committee, Department of Chemistry, Brookhaven National Laboratory. He continues as a member of the National Science Foundation Chemistry Advisory Panel and a member of the Visiting committee, Department of Chemistry, at M.I.T.—Co-Secretaries: **Phoenix N. Dangel**, 329 Park St., West Roxbury, Mass. 02132; **Irving S. Banquer**, 20 Gordon Rd., Waban, Mass. 02168

36

I regret to report the death in San Juan on December 28 of **Cesar Calderon**. He was a director of Commonwealth Oil Refining Company, Inc. and chairman of the board of both Mantecados Payco, Inc., a Puerto Rican manufacturer of dairy products, and Enterprise Hotel Development Corp. He had been engaged in experimental cattle feeding and was a former vice chairman of the board of the Government Development Bank of Puerto Rico. He was vitally interested in the economic development of his homeland and his presence will be missed.

To his wife, Sila, his daughters and son the Class extends sincere sympathy on their loss.

Ralph Van Sant, a graduate classmate, writes from the Netherlands that he is managing director of Gulf Research Laboratories NV which he has built, organized and staffed with Dutch, German, English, Swedish, Belgian, Canadian and American men for R & D and Technical Services for Gulf Oil in Europe and Africa. . . . **Norman Bull** writes from Neenah, Wisc., that he doesn't see many classmates so far north of Chicago. He reports one daughter married, the other working in Manhattan and his son Guy teaching biology in Berlin (Wisc.) High School. . . . **Harold Miller** has found no time for M.I.T. activities since the death of his father in 1968 left him the care of his mother, a stroke victim.

Martin Gilman describes a busy retirement, noting that a lot of his time is involved in church work including slide presentations of a visit he and his wife Mildred made to many of the African and Asian mission fields. They have been instrumental in collecting and shipping linens to Phebe Hospital in Liberia. The Gilmans spend one morning a week as tutors for foreign-born children as part of the Cambridge Public School Volunteer Project. It sounds like a full, rewarding retirement, indeed.

Your secretary is proud to report that she has just joined the grandparent class. My daughter Susanna and her husband, Jack Monette, have presented me with a bouncing grandson, Randall, born on February 7. By the time you read this I will have recovered my usual aplomb and will be most happy to hear from you.—**Alice H. Kimball**, Secretary, P.O. Box 31, West Hartland, Conn. 06091; or until June 1, 1970, 221 Lake View Avenue, Cambridge, Mass. 02138

37

Henry S. Stern, Jr., President of the Burlington Worsted Division, has been named president of the New York based Burlington Woolens Division. . . . **Edward L. Bartholomew, Jr.**, Professor of Metallurgy at the University of Connecticut since 1950, is planning to retire in October. Ed came to the University of Connecticut from M.I.T., having served as an assistant professor at the Institute from 1945-50. He is coauthor of a book titled *Introductory Engineering Materials* and has contributed numerous research papers and articles to technical journals. During World War II, he worked on the metallurgy of enemy material and flame hardening of armour plate. Ed also has conducted research on the metallurgy of titanium and the strengthening mechanism of steel. He is past chairman of the Hartford Chapter, American Society for Metals, past president of the Hartford Engineering Club, and a member of several professional and honorary societies. . . . Mrs. **Nancy Klock** is still teaching electrical engineering at the University of Hartford in West Hartford. Her son Peter is still at Johns Hopkins, hoping to get his Ph.D. in biophysics within a year.

Dave F. Tuttle writes he has "just returned from a year as professeur associé at the Faculté at Marseille (France) while on a sabbatical leave. A remarkable year, what with a good teaching load plus the experience of trying to make work the 'loi d'orientation' that Edgar Faure managed to get passed for the reform of French higher education!" . . . **Harry B. Goodwin** was recently promoted to assistant director (General Administration), Columbus Laboratories, Battelle Memorial Institute. Harry writes "this is a contract research organization with a staff of 2,800 people and annual research volume of 50 million dollars." He has one son at Ohio University, one daughter married, one son in the U.S. Army and a daughter in high school who trains horses. Harry's wife, Mell, has become well known in local artistic circles with a new art form that she invented—a special type of painting on weathered wood, depicting mostly wild-life.

Rutherford ("Bob") Harris writes that he attended "a very successful M.I.T. Regional Conference in Cleveland in which **Art Zimmerman** was very active as vice chairman of the conference committee." Bob has a daughter Sally, who lives in Watertown, Mass.; her husband is lecturing on archeology at Brandeis University. His son Ford is a junior at Miami University, Ohio. . . . **Margaret Mace Kingman** writes, "during the summer of 1969 initiated and conducted seminar and field study in geographic perception for blind students and for sighted students doing research on the non-visual aspects of the geographic environment (primarily in relation to regional recreation planning). 'Smell and tell' trails were set up on the 200-acre Peirson Place Study Center in Richmond, Mass., and

tangible maps prepared, among other projects. Am in process of organizing advisory and faculty staff so that the program can be continued as a permanent summer program."

Fred J. Altman is currently vice chairman of the Space Communications Committee of the Communications Technology Group of the Institute of Electrical and Electronic Engineers. . . . **Dave Fulton**, division vice president of Chemical Construction Corporation (CHEMICO), addressed the New York Section Meeting of the American Institute of Chemical Engineers. His topic was: "Capital Requirements in Coming Years—the Relation Between Inflation and Productivity." (see photo p. 138)

It is with sorrow that I report the death of **Jack Ostrer** who passed away on February 7, 1970. Jack for 18 years was the owner of One Stop Cleaners, a chain of drive-in laundry and dry cleaning plants. He was a resident of Belmont, Mass. for over 21 years. He leaves his wife, Gloria, two children, Marsha and Harry, his mother and a sister.—**Robert H. Thorson**, Secretary, 506 Riverside Ave., Medford Mass. 02155; Professor **Curtiss Powell**, Assistant Secretary, Room 5-325, M.I.T., Cambridge, Mass. 02142; **Jerome Salny**, Assistant Secretary, Egbert Hill, Morristown, N.J.

38

In writing these notes this month, I suddenly feel old. A note from **Nettie Kibur** states that she is "retired and enjoying the sunshine in Palm Springs". In the same mail, there was a press release from the University of Connecticut which states that Dr. **Carl Nordling** is scheduled to retire on October 1. Carl was originally an instructor at M.I.T., becoming an assistant professor at the University of Connecticut in 1944 and an associate professor in 1957.

Lloyd Bergeson has been made general manager of the Quincy Division of General Dynamics Corp., as well as vice president. Lloyd has been with General Dynamics since 1951. He had been planning manager and manager of Manufacturing Services at Electric Boat at Groton where he coordinated all design and construction activities leading to production of the Polaris submarine. . . . **Nick Wheless** is now president of the A.A.O.D.C. Nick is president of Wheless Drilling Company at Shreveport, La. The company operates three land rigs in the area, as well as seven barge rigs in South Louisiana.

Lew Hull writes: "Miggie and I enjoyed a week in Hawaii in November. Hull Corporation continues to manufacture capital equipment for the electronic, pharmaceutical, chemical and plastics industries. We opened a branch plant in Girvan, Scotland in 1968 and a joint-venture in Japan in 1969, known as Japan-Hull. As a freshman at M.I.T. in 1934, I got started in gliding soaring. I still haven't

outgrown it, and last February enjoyed a three-hour soaring flight to 24,500 feet near Colorado Springs." . . . **Joe Vallone** writes that he is now associated with Fenton G. Keys Associates, Architects-Engineers with offices in Providence. The firm also has offices in Waltham, Nashua and Putnam, Conn. Joe is in charge of the Specification Department and is also assigned to public relations.

Peter Cole writes that on January 1 he became technical director of the Washington, D.C., division of Carr Siegel Industries. . . . **Peer Cody** is now with Velsicol Can Company in Chicago, Ill.

In January, a feature article in the *Boston Traveler* was written by **Homer Oldfield**. "Barney" is president of Medidata Sciences, Inc., a subsidiary of G. D. Searle & Co. The whole point of the article was to develop the use of the systems concept of computer-based automated health monitoring to assist doctors in completing medical tests. . . . *The Magazine of Cambridge* reported that **Al Wilson** headed a 5-year-plan committee which established new progress goals for the Cambridge Chamber of Commerce.

A final reminder to you to get your reservations in for June 14th Homecoming eve concert. A prompt response should get you a seat at the '38 tables at the Boston Pops.—**A. L. Bruneau, Jr.**, Secretary, Hurdman and Cranston, Penney & Co., 140 Broadway, New York, 10005

39

Here's an excellent collection of first-hand responses from Thirtyniners, forwarded from Alumni Fund headquarters: **William Hewitt Phillips**, Course XVI, noted that recognition of '39 classmates who participated in the Apollo program would be of interest. He and **Art Vogeley**, also Course XVI, conducted simulative studies of rendezvous and docking operations. **Wilbur H. Gray**, another Course XVI alumnus, was resident manager at McDonnell Aircraft during the Gemini program. And Bill ran across **Ted Snow**, Course XV, at Houston as the Boeing representative on the Apollo program.

Soaring on a different scale: **Lloyd P. Hunter**, Course VIII, Professor of Electrical Engineering at the University of Rochester, wrote that he entered the U.S. National Soaring Championships at Marfa, Texas this year. He finished 39 out of 82, but was pleased to soar 436 miles on the free distance day to get his Diamond Distance F.A.I. Award.

From **Richard L. Steiner**, Course IV-B: "Urban consultant and Professor of City Planning at Howard University. Recently elected to Board of Directors, National Housing Conference. President, Baltimore Museum of Art." . . . **Harold Chestnut**, Course VI-A, said that he visited U.C.L.A.'s School of Applied Science in November to deliver lectures on systems engineering and analysis. "It was nice to

be on a campus again!" . . . From Cleveland, **George F. Schlaudecker**, Course X, wrote that in December he had been elected vice president—chemical operation, the Sherwin Williams Company. . . . **Burton D. Hudnick**, Course XVII, said that for the past twelve years he has been actively engaged in developing industrial and commercial real estate in New England, primarily in the greater Boston area. He spends much time during the summer and weekends at his home on Martha's Vineyard.

C. Arthur Zeldin, Course III, has taken a new position as smelting and refining manager for the Utah Copper Division of Kennecott Copper Corp. He started in September, and as of December was still in the process of moving his family.

Herman H. Hanson, Course XV, is now treasurer of the F. H. Buhl Trustees of Sharon, Pa. The trust endows and manages a 400-acre park in Sharon, a Boys' Club, a Girls' Club, and a Community Center. He is also a director of the McDowell National Bank, and continues as president of Gilbert's Insurance Agency, Inc. . . . **G. Arthur Morrell**, Course XV, left Garden City, Long Island to do product development and design work with Electro Voice Division of Gulton Industries, in Buchanan, Mich. Says he likes small town living after his years in the New York City area. . . . On the lighter side, **Irving Peskoe**, Course IX-A, says that life is "mostly mundane. Serve on local Community Relations Board, feed my family and dog, am trying to housebreak the latter; the former is trying to housebreak me. Keep wondering if life will continue to become more complex."—**Oswald Stewart**, Secretary, 3395 Green Meadow Circle, Bethlehem, Pa. 18017

40

By the time you read this column, you should have received notice of our 30th reunion during the June 12th weekend. Despite conflicts with our eldest boy, Eric, graduating from Walt Whitman High School and a scheduled Indian Guide overnight camp-out for our third boy, Mark, your secretary and wife Norma plan to go to the reunion and hope to see many of you there. Volunteers for the office of secretary for the next five years are welcome.

In answer to the annual Course V Christmas card **Sam Omansky** writes: "Nothing startling now to report to you. I am still Technical Director of the Grand Union Co. Our daughter Suzanne is now living and working in the Boston area and our son, Michael, is a high school senior. We do quite a bit of traveling and have seen much of the U.S. and Europe. Otherwise, life continues at a normally hectic pace and all seems to be going well."

The Aerotherm and REF Dynamics Divisions of Universal Oil Products Company have been consolidated to form the Aerospace Division. **Dan Karp** has been ap-



D. Fulton, '37

D. S. Karp, '40

pointed vice president and general manager of Aerospace. Previously, Dan was executive vice president of REF. . . . Like father, like son: **Dick Wilson's** son, Ben, a sophomore at Tech, is already an outstanding basketball player. In his second varsity game he scored 38 points. Ben's brother, Alex, '67, set a Tech basketball career scoring record of 1,224 points.

Irving Chase is one of the new directors of the American Institute of Management. Among his many other duties he is president of Henry Thayer Co. in Cambridge, assistant treasurer of General Microfilm Co. and vice president of Quantitest Chemical Corp. His civic activities include president of trustees of Concord Academy and president of the Massachusetts Association for Mental Health.

Russ Werby is Chairman of Directors of the Northeastern Section of the American Chemical Society. . . . In the *Magazine of Wall Street* for November 8, 1969, there is an article on **Henry Singleton** and Teledyne, the company he built from scratch in 1960 to one with sales of over 1 1/4 billion dollars in 1969. . . . **Bill Osmun** is now director-technical information for the Air Transport Association of America, responsible for developing public relations programs relating to flight operations, engineering and maintenance and new technology.

Dino Olivetti represented Tech at the conference on "The Role of the University in the Quest for Peace" held in Vienna, Austria late in August. From his short address the following is extracted: "I would like to state here my three freedoms. Freedom to think. Freedom to express. Freedom to act. In this we have to be educated. Freedom to think. It is not exactly freedom of thought. It is a certain ability to contest one's own thoughts. We have to lead our own life on some principles. Yet we must be able to constantly reevaluate them and not be dogmatic. Freedom to express is intended here not as what is known as 'freedom of the press,' but it is the ability to communicate with one's neighbor. Freedom to act is not anarchy. It is the ability to achieve with the cooperation of others, while taking the responsibility of the final act. . . . I think that universities all

over the world must have the force to be free from government directives in order to maintain intellectual freedom. Freedom to think, Freedom to express, Freedom to act and to explore together the problems of society without prejudice of creeds and beliefs. This cannot be in one day. It will take longer than the student movement, with the frenzy of youth, may think. But the protester of today will be the leader of tomorrow, and there will be new protesters for a still better society yet."

Notes from classmates: **Charles Epstein** sends "greetings." **Joe Greenberg** pens, "managing a systems analysis study of air pollution control in Iron Foundry industry for National Air Pollution Control Administration." . . . From **Abe Rockwood**, "Still working with Maurice A. Reidy Engineers, as structural engineer. Occasionally see Walter Caron who is with Ganteaume and McMullin, here in Boston." . . . Lieutenant Colonel **Kingsbury Jackson** writes "Have left the faculty of University of Southern California. Now am the contractual relations supervisor of the Los Angeles Unified School District (the 2nd largest in the U.S.)." . . . **Morris Gabel** is president of Engineering Grating Houston, Inc., and **Hy Freedman** is "still plugging along as small town dentist (Sharon, Mass.). Two children out of college, two in high school and one in first grade."—**Alvin Gutttag**, Secretary, Cushman, Darby and Cushman, 730-15th St. N.W., Washington, D.C. 20005

41

Robert Wallace Blake is shown in the *Boeing News* of December 18, 1969 receiving for Pan American World Airways the keys to the first commercial 747 jet airliner. You will remember it as the same plane which received so much publicity during December and January. Bob reports that this was one of two provisionally certified 747 "jumbo" jets of which he took delivery for Pan Am in December. On January 9, 1970 he took delivery of the first fully certified 747, just eleven months to the day after the first flight of the first test aircraft. Bob said that last June he visited the Paris Air Show with the No. 4 flight test 747 and followed it with a holiday in Normandy

and Italy. Between January and March, 1969, he took delivery of the last 12 Boeing 747's to complete a total of 160 such planes in operation at Pan Am.

Colonel **William Lamar** is reported by the Air Force Systems Command as having been among those flying a B-26 aircraft fitted out with a newly developed dual sidearm controller. This device is built into the co-pilot's seat frame for electrical flight control utilizing a system of power augmentation similar to power steering in an automobile and is expected to eventually replace the pilot's control stick or wheel. Bill is deputy director of the Air Force Dynamics Laboratory, Wright-Patterson Air Force Base, Ohio, a unit of the Air Force Systems Command and the Cornell Aeronautical Laboratory, Inc.

George W. Clark was elected to the board of directors of the Producers' Council during the council's 48th annual meeting in San Francisco recently. George is chief engineer, Lighting Division, Sylvania Electric Products Company Inc., Danvers, Mass. . . . **Miles Ross** was recently the featured speaker at the seventy-second annual convention of the National Hardwood Lumber Association at Bal Harbour, Fla. His topic treated the first Apollo moon walk and side benefits to industry from space exploration. Miles is deputy director, center operations, for the John F. Kennedy Space Center, Cape Kennedy. . . . **Leona N. Zarsky's** eldest daughter, Barbara, is in the first coed class at Yale! . . . **John P. Cutler** is an associate of Reid & Tarics Associates, Inc., Architects and Engineers, San Francisco, where he holds the position of Chairman, Design Committee.

Mitchell J. Marcus has been elected to the Board of Trustees of Beth Israel Hospital, Boston, Mass. where he is also head of the data processing committee. This marks another of Mitch's many and varied civic activities, which include those of national director and president of the Boston Chapter of the American Technion Society—advisory and fundraising arm of the 6,000-student University of Haifa, Israel, of whose board of governors he is also a member. He is also trustee of Combined Jewish Philanthropies of Boston, captain of electronics

and scientific fund-raising team, and chairman of the Data Processing Committee. He is also a director of the Jewish Vocational Service of Boston and 1969-70 president of the GET User Association, an organization for computer system users. Incidentally, Mitch also earns a living as president of an information service center, Production Systems, Inc. of Waltham, Mass.—“Along Route 128, which we call ‘Electronics Highway of America,’ ” he explains. “Our center is operated by 17 people. My younger brothers, Herbert and Gerald, are our marketing and programming arms. Then there’s a secretary, five computer operators, five programmers, a keypunch operator and two account executives. We all live off two machines and are getting a real good return.” He says that his company has the distinction of being “the very first to install a general-purpose G.E. information system. We do strictly batch processing at Production Systems. We have two duplicate systems, each with a central processor with 8K memory, card reader, card punch, four magnetic tape units, a high-speed printer, and a paper-tape reader and punch. To go with this, we have some 4,000 programs of various lengths that we have compiled and accumulated during our eight years in the computer service business. We have approximately 100 customers in our area of New England. And since we are a native and veteran in the data processing business, customers stay with us. We serve in the fields of warehousing, distribution, manufacturing, retailing, insurance processing, general contracting, and electrical and mechanical contracting. Our services extend to large computer operators as well, for whom we develop software. Also to scientific research.”

Mitch’s two brothers are also M.I.T. Alumni. After graduation, Mitch served in the U.S. Air Force, assigned to the Air Research and Material Command at Wright Field. He completed his active service as a major in 1946. He says that he is now concerned chiefly with administration and marketing. Mitch has three daughters, Lynne, Jill and Ellen. Jill is in charge of customer liaison for Production Systems. A graduate of Skidmore, she has “learned the business by being part of it.” Despite the heavy load of business and civic activities, he still

finds time for sports. In 1968 he and his brothers won the Massachusetts Midget Ocean Racing Championship.—**Walter J. Kreske**, Secretary, 53 State St., Boston, Mass. 02109; **Everett R. Ackerson**, Assistant Secretary, 831 Cranford Ave., Westfield, N.J. 07090; **Michael Driscoll**, Assistant Secretary, 23 Broad St., Nantucket, Mass. 02554

42

Jack Williams, still in Europe as Group Vice President of Studebaker-Worthington is also Vice President, Secretary and Treasurer of the M.I.T. Club of Paris. Jack reports his golf handicap up from 8 to 12 (looking for pigeons), and that his first grandchild is expected in March.

J. J. Quinn is running eighteen Twin Otter STOL aircraft serving outlying suburban commuters in the Los Angeles and San Francisco airport areas. He is Director of Flight Operations for Golden West Airlines. . . . **Joe Boltinghouse** is currently working on instrument development in the Navigation and Controls Division of Autonics in Anaheim, California.

Al Goldis describes his arrival in Russia “in a high state of anticipatory excitement and some slight degree of trepidation.” But, he said, “The Intourist people take their function of attracting tourism to the U.S.S.R. very conscientiously even though they do not seem always to get the full cooperation of other parts of the country’s administrative bureaucracy.

“We were more than satisfied and happy with our young man who knew more about American literature and drama, in which he was specializing at the University of Leningrad, than any of us did, and was far more fluent in English than my father was in Russian. We all unanimously predicted after our stay in Leningrad that this young, 21-year-old guide would one day be an ambassador from the U.S.S.R. We, equally, had no doubt that, were he permitted to emigrate to the U.S.A., he would without question become a millionaire before he was 40.

“The things that Americans would mostly worry about (i.e., secret service

agents tailing and eavesdropping, bugged hotel rooms, etc.) simply did not exist as far as we were concerned. What most Americans would not think to worry about did exist. The dining room administration hotel or otherwise, is absolutely infuriating!”

Al and his family acquired another Intourist guide for their tour of Moscow. “He was a good deal more dogmatic than was our previous guide in Leningrad. Our impression was that, the closer to the seat of power one came (very much as happens in Washington, D.C.), the more aware its citizens were of that power and the less likely were its citizens to take unorthodox positions. Shirley and the children disliked this young man because of what seemed to be his distant, businesslike, dogmatic approach to our relationship, but I took the trouble to discover facets of his behavior not immediately apparent.

“For example, on our way to visit the Kremlin a line of black limousines, escorted by noisy motorcycles, swept through the gate of the Kremlin wall, made a circle around the Square, and parked outside Lenin’s tomb a half an hour before the usual opening time. Limousine doors flew open and a group of burnoosed dignitaries, obviously Middle Eastern, were led into the tomb. I asked our guide who they were. He replied that they were a visiting Syrian delegation. I asked him what they were doing in Moscow, and he replied that they were doing the same thing in Moscow as you would expect them to be doing in Washington, D.C., namely, asking for money and arms. I ventured the opinion that his government and my government ought to take care so that delegations from smaller, ambitious countries should not be allowed to play us off against each other for whatever reasons. His reply was that I was absolutely right and he then called my attention to the fact that the Russians played chess very well and understood the functions of pawns. ‘Nuff said.’ ” [The Editors regret that the entire text of Mr. Goldis’s report could not be reprinted here. Copies of the full text, however, are available on request from *Technology Review*.]

Two items from Itek; **Cal Morser** ap-

pointed Assistant Vice President-Programs for Itek's Optical Systems Division. **Stan Golembe** became Director of Operations at Itek's Wayne-George Division in Newton, Mass. . . . **Gordon Dunnington** was recently promoted to Senior Research Engineer in duPont Company's Plastic Department at the Wilmington, Del. Experimental Station. . . . Another note from duPont: **Monroe Sadler** has been appointed Director of the Development Department. . . . Both **Carl Zietz's** son and daughter are attending the University of Massachusetts. Carl wrote that he had a kidney operation in December but is now feeling OK and looking forward to his number one hobby—golf.

Edward Todd is now Deputy Assistant Director for Research at the National Science Foundation in Washington. . . . Direct quote from **Hank Henderson**, "I made it through my freshman year at law school without blowing my mind, but law is a far cry from business and engineering. A great experience. More middle-aged executives who are tired of the rat race but who want a challenging intellectual experience might try investigating it as a second career."

Paul L. Hotte, our Class Agent has received a Certificate of Appreciation for outstanding service to the 1969 M.I.T. Alumni Fund. . . . From the *Charlotte* (North Carolina) *Observer*, we learn that **John Finger** has been appointed by U.S. District Court to set up a plan for total student and faculty desegregation of the Charlotte-Mecklenburg school districts. . . . Two graduate students with our class, **John McNail** and **Robert Seamans** have been elected Fellows of the Institute of Electrical and Electronics Engineers. . . . **George Toumanoff** has been appointed Director of Cutler-Hammer's A.I.L. Transportation Systems Division at Deer Park, Long Island. Before joining A.I.L., George spent 12 years at Republic Aviation Corporation working on development programs in the F105 series of fighter bombers.

Bill Tallman, president of Public Service Company of New Hampshire, has been appointed Chairman of the Edison Electric Institute's Committee on Environment, to serve a one-year term.

Sanford Peek writes that he is now Director of Engineering of Englehard-Hanovia Lighting Division designing and manufacturing high power radiant systems in the ultra-violet and luminous regions of the spectrum. . . . **Wen Chow** who is Professor of Quantitative Methods at California State's Fullerton Campus offers a guide service to Disneyland and to Knott's Berry Farm. He lives a stone's throw from these famous attractions at Harmony Place in Fullerton. Phone number is 714-526-1603. . . . **Dick Stout** is Director of Research and Development at U.S. Asbestos Division of Raybestos-Manhattan in Mannheim, Pa.

Musical talent of our class was represented when **Charles Walker**, founder and conductor of the Canterbury Choral

Society, led the Society with soloists, chorus and a full orchestra in a presentation of Haydn's *The Creation* at the Church of the Heavenly Rest in New York City. . . . **Bob Howard** writes, "Am now Program Manager in the transfer of manufacturing activities for the unit logic device (ULD) used in the Saturn/Apollo digital computer and data adapter from Poughkeepsie, N.Y. to Huntsville, Ala. Daughter Angelika is finishing B.S. in physics/chemistry at University of Kansas. Daughter Laurana is completing an A.B. in German at the University of Bonn, in Germany."

One late obituary just came in from last October. **Rodman Flinchbaugh**, director of Engineering Consulting Services at Poloroid died suddenly on October 25; we extend sincere sympathy to his family—**Ken Rosett**, Class Secretary, 191 Albemarle Rd., White Plains, N.Y. 10605

43

With extreme sorrow we report the tragic and untimely death of **Gregory Azarian** on February 21, 1970 following a one-car accident in New Hampshire. The founder and owner of Azarian Molded Plastics Corp. in Fitchburg, Mass., Greg was very successful in building up a fine business while raising three young daughters following his wife's death in 1965. He was always on the go; cruising on his boat, skiing and snow-mobiling, and active in community affairs. Classmates Bill Maxwell, Hap Hosley, Jim Hoey and Dick Feingold attended the funeral in Westminster, Mass., as did Frank Herlihy, '42. A donation to the Westminster Heart Fund in his memory was made by our Class. . . . Don't miss the story on page 145 which details some of **Jim McDonough's** doings of recent years. That's it for this month.—**Richard M. Feingold**, Secretary, 266 Pearl Street, Hartford, Conn. 06103; **A. J. Kelley, Jr.**, Associate Secretary, 34 Scudder Rd., Westfield, N.J. 07090

46

Sigurdur Halldorsson has sent a very fine letter from his home in Reykjavik, Iceland. Sigurdur you will recall came to M.I.T. from Reykjavik and after graduation returned to Iceland where he was married. He then journeyed again to the U.S.A. for his master's degree in science at the University of Illinois. Returning to Reykjavik, Sig worked for the Icelandic Post and Telegraph Administration until 1954 when he joined a construction firm.

A few years ago Sig formed his own consulting firm and has greatly enjoyed his consulting practice since then. He has been involved as a board member in the building of the first aluminum reduction plant in Iceland with a capacity of 60,000 tons per year. The Halldorsson family has five children. The oldest son is studying medicine in Iceland, and the second son is attending an engineering

school in California. Sig says he has not been very active in local politics but has spent the years enjoying his family, work and hobbies. Collecting Icelandic books and learning to fly are Sigurdur's main hobbies. Sig and his wife are planning to attend the 25th reunion and we hope this will inspire those of you who live closer to M.I.T. than the Halldorssons to make similar plans.

Ned A. Spencer has recently left his position of 21 years as chief engineer of Wheeler Labs to join the parent company, Hazeltine Corp., as director of technical planning. Ned and his wife, Irma, three children, rabbit, hamster and two dogs live in Port Washington, N.Y. Ned's oldest son entered Stanford University last fall, his second son, Andy, is a junior in high school and his daughter, Laurie, has entered junior high school. Now that the children are quite grown, Ned's wife, Irma, is at work three days per week in the Adult Education office of the high school. The Spencers are a close and active family. In January, 1969 they spent a week in Florida, in February, a ski jaunt at Bear Mt., and in the spring and summer, short trips to Sturbridge Village and the Catskills plus sailing whenever the sun shone. In March of 1969 Ned and Irma worked hard with the committee that organized the M.I.T. Eastern Conference. The Conference was attended by several hundred Long Island students and M.I.T. professors and personnel.

Peter N. Kyros stayed in the navy after leaving M.I.T., remaining until 1953 when he was discharged as lieutenant. He entered Harvard Law School and received his degree of L.L.B. in 1957. Pete is now a U.S. Congressman from Maine and lives, of course, in Washington, D.C. Pete and his wife, Alice, have two children, Peter and Joanne Carol. . . . I just received a short, informative note from my old friend **Dan M. Kelley**. Dan also remained in the navy after graduation and served as a naval officer in World War II and the Korean conflict. Dan now lives in Park Ridge, Ill., where he has recently been appointed advertising sales manager of *Nation's Schools* and its sister publication *College and University Business*. Dan previously had been sales manager of two other McGraw-Hill publications, *Modern Hospital* and *Modern Nursing Home*.

Ernie Buckman is vice president-leasing for the Oliver-Tyrone Corp. of Pittsburgh. The company is engaged in the development and ownership of high-rise office buildings in the U.S.A. The Buckmans' oldest daughter graduated from Sarah Lawrence in June, 1969.

And now a short note from **Bill Vannah**: Bill and his family live in Walpole, Mass. The eldest son is at Norwich University and the elder daughter is a freshman at Alfred University. The other three children are in high school and grade school. Bill and his second son recently explored diesel combustion experiments in Building 31 with Professor Rogowski.

Accolades, if you will, to all the Area Chairmen on the Reunion Committee! You guys have done quite a job in stimulating reunion interest and the Boston group is planning upon your delivery of many many bodies in mid-June. Please keep up the good work.

The following random items developed as bylines of our most successful January 30 meetings. **Matthew "Red" Harrington** after almost two years at Shell Oil headquarters in Manhattan is off to Houston with all the other Shells. Red will be charged with retail sales management, but how he wishes his tour as New England manager had been more than two weeks! Red and Jane hope to attend the reunion, but at the moment Red is scheduled for London our reunion weekend. **Bob Irvin** continues as a G.P. in Manahawkin, N.J. **Sam Haines** serves Berks County, Pa. as Sewer Commissioner, while Dr. **S. Gordon Smith, Jr.** is with the Fabrics and Finishers Division of E. I. DuPont in Philadelphia.

The Alumni Fund advises that **Jerry Quinnan**, Class Agent, will receive a Certificate of Appreciation for his Alumni Fund efforts during the past year. Although Jerry reaps the award it would not have been possible without your gifts and effort. . . . **Ralph Gerber** is

President, Trans Caribbean Shipping, Ltd., New York City. . . . **James Strnad's** wife, Edna, reports that the Strnads are in the midst of the "College Dialogue" which is a fine way of putting the dilemma many of us and our children face daily. Despite Edna's 25th at Vassar and Jeff's graduation, the "J. J." Strnads expect to be in Cambridge in mid-June.

Leslie G. McCracken, Jr., Associate Professor of Electrical Engineering at Lehigh University has received the following citation in the *Dictionary of International Biography*, published in England: "This Certificate of Merit proclaimed throughout the World is awarded to Leslie Guy McCracken, Jr. for Distinguished Service as an Engineer, Scientist and Educator and is the subject of notice in Vol. VI, Dictionary of International Biography". A member of the Lehigh faculty since 1956, Les is a specialist in the fields of electromagnetic wave theory and automatic control theory.

After many years as a professional engineer, including the ownership of an engineering firm, **Don Ostrower** returned in 1968 to enter Columbia Law School where he is an honor student and on the Columbia Law Review. **William B. Miller** has returned from a year at the Univer-

sity of London where he received an M.S. in electrical engineering. Bill is back working at U.S.A.F. Cambridge Research Labs making rockets and satellites. . . . At times the news clipping service is misleading; as an example, the National Real Estate Investor recently announced that **Sherry Ing**, after 11 years as Executive Vice President of Finance Investment Co., had resigned to go into business for himself. Now those of us who have followed Sherry's activities through the years know that he has always been in business for himself! Let's hope the Ings win the Long Trip Award at reunion time.

Professor **Bill Linvill**, chairman of Stanford's Engineering Economic Systems Department, recently spoke at a Stanford University workshop, "The Engineer and Society." The theme of Dr. Linvill's paper was that a new breed of engineer was being trained to discover ways that society can enjoy modern technology without suffering from it. One can readily visualize the interface between the two disciplines within Bill's department.—**C. H. Springer**, Secretary, MFB Mutual Insurance Co., 420 Lexington Ave., New York, N.Y. 10017

Bill comments that his son and the professor were over his head in their discussion of air pollution, retarding fuels, efficiencies and other engine lore. **William A. Klemm** has accepted a position as Associate Professor of Chemical Engineering at Indiana Institute of Technology in Ft. Wayne, Ind. Bill was formerly with Kaiser Aluminum & Chemical Corp.

Stanford D. Blitzer has joined a small electronic controls manufacturer, Philadelphia Scientific Controls, as chief executive officer. . . . **Donald A. Hurter** has joined the Arthur D. Little Company. . . . **Frank R. Stevens** is now associate director, Division of Sponsored Research at M.I.T. . . . **Arthur Y. Taylor** has been promoted to the grade of Fellow by the I.E.E.E. for his leadership in the planning and management of nuclear power.

For those of you attending the M.I.T. homecoming this year, remember the dates—June 14 and 15. Symphony Hall, the Pops and Arthur Fiedler have been booked for M.I.T. for June 14. There are only 1,186 table seats and preference is given to the classes having the 50, 40 and 25 year reunions. Therefore, send in your reservation for the evening to Mr. A. L. Bruneau, Jr., 140 Broadway, New York, N.Y. 10005 as soon as possible.

Many thanks to those of you who have written us during the past months. I wish the large silent majority of the Class would be less silent and sit down to write

us a short note on their activities. Sincerely.—**Russ Dostal**, Secretary, 18837 Palm Circle, Cleveland, Ohio 44126

47

This issue finds us with skiing plans and a rather busy and hectic business schedule so these notes may be brevity in the extreme. **Bob Rediker** has been awarded the Sarnoff Award for his contribution to semiconductor device research and injection lasers. Bob is now Professor of Electrical Engineering at the Institute. . . . **Bob Mack** has been named chief of avionics development by Kaman Aerospace Corp. Bob is a co-holder of several patents on helicopter remote controls and the first person to operate a pilotless helicopter by remote control.

Marty Phillips, my predecessor with this job, has been appointed an Associate Director of the Alumni Fund. Marty now has his own firm, Growth Planning Associates, to specialize in corporate planning, mergers and acquisition and executive recruiting. We will have to remember him when we are thinking of changing jobs. . . . **Herb Schmidlin** is now General Manager of the Manhattan Manufacturing Division of Raybestos Manhattan in Neenah, Wis. . . . **Louis Wanaselja** has recently joined, and is now Vice President of, process engineering with Ray Consulting in Highland Parks, N.J. where he will oversee chemical, petrochemical and oil projects.

Quite a few of our notes are quite topical from the news and problems of today. **Alex Pastuhov** and **J. A. Fay** have both written articles on handling oil spills in the sea. I personally have seen neither, so maybe they agree. . . . **Quentin Groves** is finishing his term as president of the Board of Education in Berkeley Heights, N.J. Since this has been a growing suburb of New York City, I assume he has had fun. Quentin also takes a moment to compliment **Dick Mooney** on his proposal for the 25 year gift which is certainly timely. . . . **Ken Block** has been elected president of the Chicago Crime Commission, which appointment speaks for itself. . . . **John Blackwell** is now chief land use planner for the Massachusetts Department of Natural Resources working essentially on outdoor recreation.

Ruth Milesen finds her years of full-time mothering are ending and is taking courses in geology and oceanography. This should lead her to a career as professional beachcomber, but we shall refer to her as a coastal ecologist to fit in with the news media. . . . **Jim Prigoff** writes a very pleasant letter to advise that he is now Executive Vice President of Rosenau Bros. and a member of the board. He is also on the board of several Philadelphia concerns. Time really flies, as his daughter, Gail, graduates from Sarah Lawrence this year. Older son, Bruce, is at Beloit College and the youngest, Lynn, is a junior in Scarsdale High School. Second son, Wayne, was an All League choice from the best football

team that Scarsdale has produced. He must be following Dad, who has retired from a seven year string as National Squash Tennis Champ. Jim also enclosed a copy of a letter he wrote to President Howard Johnson expressing his displeasure at the handling of the incidents in January. His displeasure, if I may summarize, is basically due to the lack of dialogue between administration, faculty and students. Jim's wife, Arlene, obtained her masters in social work and works full-time in a demonstration work program in Central Harlem, so they are deeply concerned.

The same mail brings a note to Claude Brenner from **E. C. Doyle**, pointing out that he cannot tolerate the Institute cowering under the pretext of "guaranteeing intellectual freedom." As I recall, our 25 year gift is to provide funds to foster, hence provide, closer faculty-student relations. At this writing, I shan't try to editorialize, but I do feel that our 25 year gift is certainly timely. Messers Prigoff and Doyle see things from opposite sides, and I hope I did not misquote them. Ours is being continually chastised as the silent generation. There is certainly unrest in all of the schools and obviously at the Institute. There are some 640 of you that supposedly receive this publication—what are your views on this subject? With this question, I had better sign off, pack my skis and head north.—**Dick O'Donnell**, Secretary, 28516 Lincoln Rd., Bay Village, Ohio 44140

48

Our class has been invited to join M.I.T. at the Boston Pops with Arthur Fiedler at Symphony Hall on Sunday evening, June 14. Tickets are available as part of the M.I.T. Alumni Homecoming Weekend events. The 25th and 40th reunion classes will be on campus for the weekend of June 12-15. On Monday, June 15, Homecoming Day, the planned events include an opportunity to drive the electric car that will be raced to California in competition with Cal Tech. . . . Tickets for the 1,186 table seats at the Pop's main floor of Symphony Hall are on a first-come first-served basis. If you register early, '48 will be assured of tables together at the Pops. Refreshments are available at the tables.

As a member of the committee planning this year's Homecoming, I am personally familiar with the excellence of the program planned for you. My experience has been that we make our decision to attend Homecoming or reunions based on whom we expect to join us at the event. This year at the Pops, '48 will be represented by at least the following classmates: Ken Brock, Sonny Monosson, George Wayne, Bob Bliss, Dick Harris, Dick Baker, Jack Juechter, Stan Palmer, Ed Hanley, Frank Heger, John Reid, Jack Page, Verity Smith, Harold Ottobriani, Haig Yardumian, Bob Wofsey, Dave Finnegan, Ben Brettler, Albert Kelley, Bob Lovezola, George Macomber, Don Noble, and yours truly. Naturally, most of these

classmates are close to Boston, but as the reservations come in, you can be sure that some world travelers will be included.

Michael J. Kami, Course XV, visited the Orient for a business-pleasure trip to address the 15th international meeting of C.I.O.S. in Tokyo. Mike's letter described fishing off northern Australia for black marlin. Considering that the world's record is a 1600-pound fish, it was a great objective. Lots of fun, but no fish! Mike lives in Lighthouse Point, Florida, and he invites classmates passing through the Sunshine State to join him in a fishing expedition. . . . **Norman Shillman**, Course XIV, wrote expressing interest in our class notes, and he suggested sending a questionnaire to classmates asking for news. Typically, Norm did not reveal a single bit of current information about himself other than his address, which is 106 Hopkins Place, Baltimore. My files remind me that Norm was at our 20th reunion at Edgartown. The '48 *Technique* indicates the following about Norm: went to high school in Baltimore, Veteran's Association, Nautical Association, Field Day Sports-Tug-of-War, Lacrosse-Assistant Manager, and member of Pi Lambda Phi. Maybe some other Pi Lamb's will write me and say something about Norm.

Ralph Segel, Course VIII, is Professor of Physics at Northwestern University, and also a staff member at Argonne National Laboratory where he is conducting a program in Nuclear Physics research. . . .

Robert Burrows, Course I, is teaching at Walla Walla Community College in Washington. Since retiring in 1966 from the U.S. Army Corps of Engineers, he attended graduate school and worked for a consulting engineering firm in Oregon.

Norman Herbert, Course II, is teaching at Broome Technical College in Binghamton, N.Y. He needs one course and a dissertation for a Ph.D. His farm has a herd of six horses, including a mare that he plans to breed. Based on his memories of sailing at Tech, Norman recently purchased a sailboat and has resumed sailing. . . . **Norman W. Stewart**, Course XVI, has joined Kuhn, Loeb & Co., and has been made a general partner. His responsibilities primarily include activities related to fixed-income securities. From 1965 to 1969 Norman was a member of the board of governors of the American Stock Exchange.

Three members of our class received Certificates of Appreciation for their efforts on behalf of M.I.T. in the 1969 Alumni Fund. They and their co-workers played important roles in making that Fund Year the great success it was.

Jack Page was special gifts chairman in the Dallas-Ft. Worth area. **Joe Bongiovanni** was regional chairman in Syracuse, a region with more than 100 prior contributors. **Bob Wofsey** was regional chairman in Newton. . . . Cabot Corporation announced that **George E. Stewart**, Course XV, has been made general manager of the Plastics Division in Louisville.

Nicholas Dewolf, Course VI, president of Teradyne, Inc., presented a paper on "Starting a New Company." . . . **Norman L. Seltzer**, Course XV, is president of Dappatex Corp., the disposable products firm in which Levi Strauss & Co. has a majority interest. Norm founded Dappatex, which manufactures disposable assemblies of paper, plastic and textile fibers. . . . Stanley C. Scheier, '57, is director of engineering and development for Dappatex. . . . **Leon B. Groisser**, Course I, is Assistant Professor of Structures at M.I.T., where he is taking part in a project in the department of architecture. "The Architecture Machine" is a project to build a machine that will have "experiences" in the field of architecture. —**S. Martin Billett**, Secretary, 16 Greenwood Ave., Barrington, R.I. 02806

49

Dave Eberly starts on a somber note with a letter written in late January to the Alumni Association, as follows: "**Edward P. Stoessel**, Course II, 1949, was suddenly and tragically killed last week in an industrial accident. Ted was a lifelong friend as well as classmate, our friendship going back to high school. We have stayed in touch over the years. . . . Ted was my son's godfather and Ted's wife, Janet, was part of our group before and after their marriage. I believe I am qualified to judge, therefore, that Ted was one of M.I.T.'s finest alumni, both professionally, where he rose to an eminent position with one of the nation's top constructors, as well as personally, where he lived the highest values of citizenship. I would appreciate your informing the Class Secretary so that the class notes may reflect our memoriam to Ted. The enclosed modest contribution to the Alumni Fund should be noted on behalf of Edward P. Stoessel." Our deepest sympathy goes out to Ted's family.

In a more welcome vein, we have several notes from Alumni Fund envelopes. **Bill Mitchell** reports that he is primarily engaged in land development and other real estate projects. He married Marilyn Miller in November, 1966, and now has two children, a boy, Stephen, born in 1968, and a girl, Sarah, born in early 1970. Bill says he does not expect to keep up with **Milt Bevington**. . . . **Arthur Halenbeck** is director of systems engineering for U.S.A.F. Satellite Control Facility with Aerospace Corp. He is living in a spread-out house above Zuma Beach in Malibu with wife and five of seven children not yet out of the nest. Art reports that he spent five years on the Manned Orbital Laboratory program as director-orbital operations system.

In following the Apollo Program on television and elsewhere, you will all have seen pictures of the Crawler Transporter, the monstrous unit which moves completed Apollo vehicles and their umbilical towers from the assembly building to the launch pads at Cape Kennedy. **Philip A.** (Continued on page 146)

Never Say Never

Since its early interest in the design of numerical control equipment for machine tools and industrial processes, Concord Control Inc., founded in 1956, has established itself as one of the world's leaders in the design and production of automatic cartographic equipment.

President and founder of Concord Control, **James O. McDonough**, '43 E.E. (S.B., S.M.), had previously helped to design, as a member of the M.I.T. research staff, the unique instrumentation and control system for the nuclear reactor at the Brookhaven National Laboratory.

As manager of numerical control projects at the M.I.T. Servomechanism Laboratory, Mr. McDonough was engineering manager for the design and development of the first electronic computer-controlled machine tool system for three dimensional milling. This unique work provided both concept and impetus to a new utilization of digital computation and control which is now considered the most important metalworking advancement in recent decades.

Herbert P. Grossimon, E.E. '50 (S.M.), Vice President-Operations and also a founder of the firm, and **Peter N. Heller**, E.E. '51 (S.M.), Senior Engineer, are both from M.I.T. "Mr. Heller," said company spokesman and sales manager Jonathan R. Fadiman, "is a recognized leader in the field of servomechanisms." Mr. Grossimon, along with Mr. McDonough, is recognized as one of the country's leading authorities on precision control and logic systems. He is credited with key contributions to the advancement of the art of numerical control for machine tools.

One Thing Leads to Another

Assignments for Giddings and Lewis Machine Tool Company of which Concord was initially a subsidiary, led to pioneering work and several patents in the machine tool control field. A subsequent parting of the ways with Giddings and Lewis and a dip in business, however, sent Concord in search of new markets for its skills. Until 1962 the company was involved among other things in the design of such equipment as buoy transmitters and locating beacons for oceanographic use.

In 1961 Concord contracted to supply the U.S. Naval Oceanographic Office in Washington with a system for automated

plotting of marine charts. Called the Precision Digital Coordinatograph, this automatic plotter was the first machine with the size and capabilities required to produce direct negative engravings of cartographic quality. The resulting graphic output consisted of finished scribecoat sheets which could be used directly in the production of a printing plate. This plotter—the producer of a usable product not merely a display device—was a great success. It became the base on which Concord started to build ever more sophisticated location/logic machinery as well as its reputation in automatic cartographic equipment. Mr. McDonough and Mr. Grossimon were quick to seize upon the value of the small general purpose digital computer as a control element. Consequently, shortly after the introduction of the first such low-cost computer, they led the way in the application of such a computer to direct a complex automatic cartographic system including a high precision plotter. The high degree of interaction between a modern computer using an advanced program, an operator, and specifically designed input-output equipment has continued to be a key to Concord's success.

The designing of plotters, digitizers and complex systems for the rapid conversion of digital data to graphic data and vice versa has convinced the firm's staff of the importance of the operator and the limits to the computer. Their concept of human engineering means that in the course of designing systems, those functions best accomplished by human judgment and skill are distinguished from those best accomplished automatically. It is on this basis that functions are assigned. The result is a harmonious man/machine relationship.

A new challenge to Concord's engineering ingenuity came from the Max Levy Company, a firm in Philadelphia specializing in precision glass rulings. The requirement here was for a large plotter (60 by 60 inches), which could produce arbitrary patterns in two dimensions on special photo-resist coated glass at relatively high speed (60 inches per minute) with extraordinary accuracy (absolute precision of 0.0001 inch and repeatability of 50 millionths of an inch). No such system existed, but the president of the Max Levy Company felt that if the job could be done at all, Concord Control could do it.

To design the plotter Concord chose the conservative approach of refining techniques already learned from its cartographic equipment experience. Though there were difficulties to overcome, none proved insurmountable. The proof of this is that a system meeting the customer's design requirements was recently shipped and is now being put into operation.

The basic stability of this large Concord instrument is assured by its base, a seven ton slab of California black granite hand-polished to be flat within 0.0004 inch. Mounted on the granite are meehanite beams which support the hardened steel tracks; the tracks are hand-worked until they are parallel, coplanar, and straight to better than 0.0001 inch over the entire 60 inch length. Three precision ground ball bearing screws, preloaded to prevent backlash, are used to drive the plotter in the X and Y directions. Each screw is instrumented with its own precision optical encoder for position measurement. Computer correction is applied to the screws to calibrate out even the tiny residual errors left in the screws after the most careful hand lapping processes. The control and driving of the screws are accomplished by Concord's high performance servomechanism system so successful in its earlier cartographic plotters. Calibration of the system to its final accuracy is performed with a laser interferometer.

Concord Art Work Generator

Concord's work for the Max Levy Company has led to its latest development—The Concord Artwork Generator—a computer controlled high precision system for the production of integrated circuit artwork masters. These masters define the elements of each layer of an integrated circuit. By virtue of machine's great accuracy (20 millionths of an inch over an 8 by 12 inch area) and fast linear plotting speed (25 inches per minute), this system can produce artwork masters at ten times final size—the size required to feed directly to a step and repeat camera. No longer is it necessary to work at 200 to 1,000 times final size and suffer the speed penalty of plotting so many inches of line and the difficulties of multiple photoreduction steps. This new system promises to provide to the integrated circuit manufacturing industry economy of operation, speed of production, and accuracy never before possible.

Koehring was manager of the *Crawler Transporter* for the Marion Power Shovel Co. (M.P.S.), Marion, Ohio. He has just returned from London, England, where on December 18 "N.A.S.A. and M.P.S. were awarded, by the Royal Automobile Club of Great Britain, the Diamond Jubilee Trophy for outstanding advancement in land transportation. Although this award is available on a yearly basis, it has been presented only twice before in the twelve years it has been in existence. Both previous awards were to men from the U.K.: to Sir Vivian Fuchs for perfecting a snowmobile tractor with which he crossed Antarctica, and to Sir Christopher Cockerell for the invention of the Hovercraft. The award was made to N.A.S.A. and M.P.S. by the Earl Mountbatten of Burma, Admiral of the Fleet." . . . Your secretary is abashed to discover the above item only at this late date. He was in London on December 18, also, presenting a paper, "Task Forces: Temporary Social Systems for Organizational Change," to the 2nd joint conference sponsored by the Operational Research Society and several societies in the behavioral sciences. A far cry from undergraduate and graduate physics.

David K. Felbeck, who received a graduate degree with our class in 1949, writes as follows: "Please tell **Erwin Loewen** that I think that more than 28% of M.I.T. graduate student alumni ought to be contributing to the furtherance of the Institute. After all, how do they think they got where they are?" . . . From the *Wall Street Journal* of January 7, comes an announcement by the Trane Co. in La-Crosse, Wis. that **E. Milton Bevington** was elected a vice president and named general manager of the new consumer products division of this maker of heating and air-conditioning products. Is this promotion because you control so many consumers, Milt? . . . Wentworth Institute in Boston announces that **Willard F. Heintz** has joined the staff as architectural engineering technology instructor, starting with the fall term, 1969. . . . **Earl W. Eames** writes in early November that he is now with Nelson Associates, Inc., in New York City.

Harold Proctor reports that in February 1969 he became General Manager of Gabriel Electronics Division of Maremont Corp. in Saco, Maine.

Jack Fogarty sent us his Christmas letter with the following newsy information: "This spring Jack left Optisonics and joined General Atomics, a subsidiary of Magnavox, as staff engineer in the Communications Research section. He enjoys the technical challenge and working with old friends from Univac, M.I.T., and Philco. Another fringe benefit: the plant is less than two miles away through residential area and Jack has been bicycling it every day in good weather—and coming home for lunch, too. Also, Jack is retreading the old M.S. at the U of P's Moore School with a course in modulation theory requiring study every night"—his second job, Peggy calls it.

Leonard F. Newton has been appointed to the board of Opinion Research Corporation. Now an O.R.C. vice president, Len joined the firm as a research analyst 18 years ago. He is currently responsible for over 50 major accounts. Len discussed his many community activities in September at M.I.T. at the Alumni Officers Conference. The news release confirms his activity as follows: "A well-known community leader, Mr. Newton serves as chairman of the board of the Princeton and Mercer County Community Action Councils (O.E.O.), elder of the Witherspoon Presbyterian Church, advisory director of the Franklin State Bank, on the board of directors of the M.I.T. Alumni Fund, and on the editorial advisory board of *Technology Review*." Good work, Len, and congratulations.

Neil D. Morrison has been named vice president in charge of computer operations, a newly created position at the Computer Control Division of Honeywell Inc., Framingham. He will be responsible for the division's computer engineering and manufacturing operations as well as for the manufacture of its digital product line. What will you do in your spare time, Neil?

We have 2 notes on **William Haddon, Jr.**, M.D., President, Insurance Institute for Highway Safety, in Washington, D.C. He received the 1969 Bronfman Prize for Public Health Achievement from the American Public Health Association on November 13, 1969 during the 97th Annual Meeting of the Association. Established under a grant from the Samuel Bronfman Foundation, the award includes a scroll and crystal cube and a \$5,000 honorarium. The citation notes that Bill pioneered in the development and application of epidemiological methods to the study of injuries and accidents. His research accomplishments led to Dr. Haddon's selection as Director of the National Highway Safety Bureau, and it was under his direction that the program for recalling unsafe vehicles was initiated, that the safety standards for automotive tires were developed, and that vehicle inspection activities at the state level were implemented.

Later, in early December, Dr. Haddon served as a member of the U.S. delegation to the first meeting of the Committee on the Challenges of Modern Society established by the North Atlantic Council of N.A.T.O., held at the N.A.T.O. headquarters in Brussels. . . . There are one or two items reporting papers which I will postpone until next month, since the *Review* deadline awaits, and I must be off to the Caribbean for a luxuriant two-week vacation. Isn't it nice that by the time you read this there will no longer be reason to be jealous. If you are in the vicinity of Boston, remember that the Class of '49 is sponsoring an annual cocktail party again, in connection with Alumni Day, whatever its special title this year. Further details next month. Hope you are all having a lovely spring.—**Frank T. Hulswit**, 77 Temple Rd., Concord, Mass. 01742

50

Last June, **Edward C. Clark** received a Ph.D. in oriental studies from Princeton University. . . . U.S. Air Force Lieutenant Colonel **Jack E. Downhill** received the Meritorious Service Medal during his retirement ceremony at Los Angeles Air Force Station, Calif. Colonel Downhill, a veteran of more than 27 years service, distinguished himself as program director, medium launch vehicles at the Space and Missile Systems Organization, Los Angeles. He was cited for his outstanding engineering and professional abilities. The Colonel served in the European Theater of Operations during World War II and has served in Vietnam. His wife is the former Gwen-dolyn J. Haight from Canada.

Don't miss the news on p. 145 of **Herbert Grossimon** and his involvement with Concord Control, Inc. of Boston.

It is with deep regret that we report the death of **Morris I. Cohn**, Course X, who passed away on March 6, 1970.

Paul F. Eberhard has been promoted to Senior Engineer in the Electric Distribution Department of the Public Service and Gas Co. in Newark. Mr. Eberhard started with Public Service in 1950 as a cadet engineer after graduating from M.I.T. He subsequently has held the positions of assistant engineer, engineer and division service engineer in the Bergen Electric Distribution Department and division substation engineer in that department. . . . **Jack J. Jackson** has been appointed president of National Management Services, Inc. in New York, a new subsidiary of the National General Corporation in Los Angeles. Mr. Jackson described the new company as providing a total systems capability in the management information field, with particular emphasis on serving the leisure time and financial service fields. Related services offered by the company include corporate planning and consulting, work measurement and control, and the design and implementation of automated clerical systems and procedures. The company plans to move in the fall of 1970 to Los Angeles upon completion of a new building adjacent to National General corporate headquarters. Mr. Jackson and his family reside in New Jersey. . . . For some time, **F. F. Sadri** has been design coordinator at A.G. Odell, Jr. & Associates, one of the largest A-E firms in the southeast.

James V. D. Eppes of Lehigh University was the recipient of a special award from the university's Department of Athletics and Alumni Association for his volunteer work in aiding the gridiron squad since the advent of television. He has spent much of his free time, and made use of personal equipment, to film practice sessions for coaching staff use. Professor Eppes is with the university's Department of Mechanical Engineering. —**John T. McKenna, Jr.**, Secretary, 2 Francis Kelly Rd., Bedford, Mass. 01730

51

Nicholas Browne is with the Culligan Water Conditioning Co. and lives with wife Faye and children David, 6, and Deborah, 4, in Leawood, Kansas. . . . **James O. Cobb** is now with North American Rockwell Corp., Los Angeles Division, in a systems analysis group. As reported in February, Jim retired from the Air Force (as a Colonel) after 30 years of service. Jim and Frances have two children, Alison, 19, and Cynthia, 17. . . . **Glenn Eichenseer** has been promoted to Executive Vice President and General Manager of Servomation of New England. Glenn has been with the company since graduation from M.I.T. . . . **Patrick Griffin** is Manager of Puerto Rico Olefins Co. and lives in Palos Verdes Estates, Calif., with wife Monica and Bridget, 7, Monica, 5, Shauna, 3, Moya, 1, and a new baby as yet unnamed. . . . **John Hathaway** is with the U.S. Geological Survey in Woods Hole, Mass. and had a paper published on "Methane-derived Marine Carbonates of Pleistocene Age."

Class news is a strange thing. It runs in cycles and all of the secretaries seem to respond simultaneously to the same loyal people who send us news. For example: **Maurice Hedaya** sent us a couple of notes including his social security number to let us know that he still has to work for a living to support wife Gladys and children Betty, Ezra, Sarah and Solomon. . . . **Adolph C. Hendrickson** has founded the Hendrickson Corp. to provide software computer systems and services to clients. The company is located in Washington, D.C., and Adolph resides in Silver Springs, Md. Constance and he have four sons between the ages of 23 and 9.

Ernest Holzmman, Course VI, S.M., has joined the Systems Engineering & Analysis Branch of the Information Sciences Lab at the Research and Development Center of General Electric in Schenectady, N.Y. He has also been appointed an Adjunct Professor at Union College and teaches a course in automatic control theory. . . . Gloria and **John Lang** live in Tulsa, Okla. with children Jana 15, John 14, and Maree 10. John has just formed his own corporation for building homes, apartments and commercial buildings.

Robert Lazzopina has been appointed by Honeywell, Inc.'s Industrial Division of Fort Washington, Pa. as Manager of a newly formed advanced automation group. He formerly worked for Burrough's Corp. in Paoli, Pa. He lives in King of Prussia, Pa., and he and Marilyn at last count had 5 daughters and 2 sons! Ages range from 7 to almost 17.

Bill Moon is Works Manager for Kearney National and would like to hear from any classmates in the Atlanta, Ga. area. The competition is tough: Bill and Consuela have 6 daughters and 1 son with only slightly greater spread than the Lazzopinas. . . . **Gene Oster** has accepted a new job as General Manager of Elec-

tro-Optical Display Development with Owen-Illinois, Inc. He was formerly Director of Engineering Research for the same firm. He resides in Toledo, Ohio with Carolyn, David and Jennifer.

Charles Haeuser has expanded his architectural firm. It's now Losch-Haeuser, Inc. They have a varied practice ranging from county park buildings and homes for the aged to triangular and octagonal churches. The Haeusers have four children, Tex, 17, Gus, 15, Heidi, 14, and Tony 12. . . . **Walter E. Johnson** is Manager, Metallurgy, at General Electric's Major Appliance Laboratories in Louisville, Ky. He is active in church and youth work, sports and technical societies. He and Virginia have a son, 17 and a daughter, 14.

Douglas F. Kaufman is with the Whittaker Corp. at what used to be the Nuclear Metals plant (old M.I.T. Hood Bldg. project). The Kaufmans have 3 children. . . . **Walter Schwab** has been appointed a Professor of Electrical Engineering at Northeastern University. He lives in Dover, Mass. . . . **Dave Rowe** writes that he is Chief Design Engineer and still with Hurst-Rosche, Consulting Engineers in Hillsboro, Ill. with whom he has spent the last 14 years. Dave and Ginsy have only four children. . . . **Howard Schwartzman** is now Senior Project Engineer for Beech Nut, Inc. in Canajoharie, N.Y. He has acquired an old mansion in nearby Fort Plain. Howie, Eve and Theresa Bell, one year old, summer at their cottage on Canada Lake, N.Y. . . . **Charles (Hank) Spaulding** was elected Vice President of Building, Owners and Managers Association of the Greater Boston Real Estate Board and his picture has appeared in the local papers including a big Sunday supplement in the *Boston Herald*. Hank is President of the management company of Spaulding & Slye of Boston, which is developing some substantial properties in the greater Boston area. By the way, he and Anne also have 7 children.

Armand Tanguay, Course VI, is now with Medical Diagnostics Operations, Xerox Corp. in Pasadena, Calif., as Manager of Operations Evaluation Office & Product Assurance Division. His oldest son Armand, Jr. is a sophomore and Class President at Cal. Tech. Daughter and number 2 son are in high school. Armand relaxes by working with church youth groups and by sailing. . . . **Al Trakowski**, Director of Corporate Marketing and Development at Wolf Research & Development, participated in a seminar at E.G. & G. Inc. in Santa Barbara, Calif.

Walter Wells is a group leader at Lincoln Lab, Lexington, Mass. He spent two years in the Marshall Islands as Manager of Project Press and a year on special study with the Institute for Defense Analysis. . . . **Bernard Widrow** is a professor at Stanford University associated with their Digital Systems Laboratory. . . . **Robert F. White** has been appointed Design Engineering Manager at the Electro Boat Division of General Dynamics in Groton, Conn. He was Chief

of Mechanical Engineering from 1957 to 1968 and then Chief of Marine Equipment Engineering. He lives in Westerly, R.I.

Jay Rosenfield is our reunion chairman. Our 20th will be held in 1971 on Martha's Vineyard off the coast of Cape Cod. We're looking for workers and "attendees," so make your plans now. Write to Jay or your class secretaries to let us know your thoughts and intentions.—**Walter O. Davis**, Assistant Secretary, 346 Forest Ave., Brockton, Mass. 02402; **Howard L. Livingston**, Secretary, 358 Emerson Rd., Lexington, Mass. 02173; Assistant Secretaries: **Marshall Alper**, 1130 Coronet Ave., Pasadena, Calif. 91107 and **Paul Smith**, 11 Old Farm Rd., North Caldwell, N.J. 07006

52

The Raytheon Company recently announced that **R. P. Tuinila**, Course X, is co-inventor under a recent patent assigned to the company, of an improved radio frequency absorber. The multi-layer material incorporates porous, hollow, ceramic spheres, and is used to shield personnel from microwave emissions and radar systems. Mr. Tuinila is a principal engineer at Raytheon's Bedford, Mass. laboratories. He and his wife Rita live in Beverly, Mass., and have four children: Lorraine, 21, Lisa Ann, 18, Ruth Marie, 17, and Roy John Francis, 11. . . . The *Chemical Engineering Progress* for October, 1969 has an article co-authored by **Howie Zasloff** discussing the use of gas oil feedstocks for ethylene production. Howie is manager of the Petrochemical Section of the Lummus Co.

Next, we have a couple of notes from classmates who are doing well in the academic world. **Ben Dasher**, Course VI, writes that effective last August 1, he was appointed Associate Dean of Engineering at Georgia Institute of Technology. . . . **Art Freeman** writes that he has been at Northwestern University since August, 1967, as Chairman of the Physics Department and Professor of Physics. Art has a Ph.D. in physics from M.I.T. and was with the National Magnet Laboratory at M.I.T. for five years, during part of this time as associate director.

From overseas we have notes from three classmates. **C. F. Springer** writes that he is presently in Belgium with his family, building a new dyestuff mfg. plant as Project Director for Althouse Tertre, S.A. This is a new corporation owned by Crompton & Knowles Corp. of Worcester, Mass. and Carbochimique, Belgium.

James A. Berkstresser writes that he is now a registered representative with Merrill Lynch in Frankfurt Am Main, Germany (Postbox 174122). . . . **David W. Ulrich** writes that he and his wife, Barbara, moved to Venezuela in 1968. The Ulrichs now have two children: Mark, age two and one-half years, and Ann, age 13 months. They are expecting a third child in July.

Executive promotions for our classmates are still coming along in good number. **Howard H. Fawcett, Jr.** writes that he has recently been promoted to the position of manager of resource development for Newport News Shipbuilding and Dry Dock Co., a major component of Tenneco. . . . **Erwin S. Zonis**, Course X, writes that he has been named vice president of Essex Chemical Corp. and general manager of its chemical division. . . . A note from **William P. Chandler** says that he has become manager of real estate coordination and planning for B. P. Oil Corporation since the January 1970 merger of B. P. Oil Corp. and Sohio. Bill has headquarters in Atlanta and is concerned with service station site purchases in the B. P. brand territory, covering the states from Maine to Florida.

Occasionally we do hear a word from a classmate about non-business activities. **Donald Jaffe** writes that he is a member of the East Penn School Board, a most time-consuming job with no pay. Donald heads the maintenance committee, athletic injury committee, and education committee. Five Jaffe children attend school in the district: Nancy, 16, Rodger, 12, Joan, 11, Richard, 8, and Robert, 5. Donald is thin film supervisor at Bell Laboratories, Allentown, Pa. . . . **John F. Maxwell** writes that he and his wife, Liz, and children Scott, 6, and Lisa, 4 are busy adding to their Jackson, N.H. A-frame, and doing a complete interior remodeling of an 80-year-old house in Andover, Mass. The Maxwells hope that they'll be able to move in, with luck and a lot of hard work, by next summer. John is an R & D man on the staff of Avco's Government Products group at Wilmington, Mass. . . . Finally, **Timothy M. Brown** writes that he is at the Manned Spacecraft Center at Houston in the flight crew support division. Tim is primarily involved in managing support contractor effort for the Apollo Application Program and managing systems training efforts.—**Arthur S. Turner**, Secretary, Lowell St., Carlisle, Mass. 01741 or Baird-Atomic, 125 Middlesex Turnpike, Bedford, Mass. 01730

54

Bob Anslow reports that **John Rieman** is vice president and manufacturing manager of the Stocker and Yale Co., of Beverley, Mass. . . . **David Dennen** has been promoted from senior microbiologist to manager of antibiotic development at Eli Lilly and Company. Dr. Dennen is a member of the American Chemical Society and the American Society for Microbiology and resides with his family in Indianapolis. . . . **Ed Eigel** reports that he is still Dean of the Graduate School at St. Louis University. The Eigels have two children, Eddie age 9 and Mary age 8.

William Ferrini is a senior architect working on various civilian and military projects in Europe and Africa. Seven years ago Bill married an Italian architect and the Ferrinis currently live in an

apartment in the Monte Verde district of Rome and spend their leisure time in their mountain villa which they built in 1966 for weekend and summer use. They have two children, William Jr. (6 years) and Louis (5 years). . . . **Rolf Kates** reports that he is moving into a new marketing role in his company's computer group's worldwide activities.

Emil Krejci has left Aquanautics, Inc. in Sunnyvale, Calif., to join Mark Systems Inc. of Cupertino, Calif., as a senior materials engineer. Mark Systems is a manufacturer of rapid processing film and electro-optical equipment.

Raymond Mintz is program director for Management Information Systems, Operations Research Inc., Leasco Systems and Research. . . . **William Remers** has joined the faculty of Purdue University's School of Pharmacy as an Associate Professor of Medicinal Chemistry.

Francis Smith is now assigned as the chief environmental engineer for the Pacific Air Forces and is living in Honolulu, Hawaii. . . . **Eddie Joe Schwarz** was awarded the National Pilots Association's "Proficiency Pilot of the Year" (1968) award at the N.P.A. National Meeting at Basin Harbor, Vt., last spring. He achieved the all time low score in the family's "Navion" at the 5th Missouri Sky Derby in 1968 and repeated the win in 1969. Hats off to a course XVI graduate who has proven his expertise where it counts. . . . in an airplane!—**E. David Howes, Jr.**, Secretary, Box 66, Carlisle, Mass. 01741

55

Reunion time is just around the corner. We hope that you have made arrangements to attend and are looking forward to a fine get-together. Rumor has it that there will be prizes awarded to the Class members who have (1) gained the least weight in the past five years; (2) sustained the least recession in hairline; and (3) who are able to conclusively prove that he (or she) can still fit into the same suit that was worn at graduation—by actually wearing it to the banquet. Kidding aside, let's all plan to go.

We received a note from **Donald Brennan** about his marriage to Mona K. Sheldon of Seattle, Wash., who is a graduate of the University of Washington and has been working as a confidential assistant in the office of the Secretary of the Interior in Washington. As you may have seen or heard, Don has been quite active on behalf of active missile defense. . . . **Gil Davidson** who is a Vice President at American Science & Engineering in Cambridge was made head of the new Instrument Systems Division. Gil, Barbara and the three children live in Newton.

Eduardo Elizondo decided to learn to play the guitar this winter. Although Ed is interested in music, he felt that this might be a better tack to take than skiing, since he unfortunately spent all

summer in a cast recovering from an end-of-the-season skiing accident last spring. Ed is a communications systems engineer for the Tiros/Essa operational weather satellites at the R.C.A. Space Center in New Jersey.

Robert Elvidge writes from Detroit that he is the President of the "above company" which is busily engaged in pickling steel sheets. Unfortunately, the Alumni Association cut off the "above address" so you will have to write us again, Bob, in order to get a plug for your company. He goes on to say that Lynette and the three children have been living at the above address for the last year. Needless to say, that address had been cut off too.

Norman A. Poulin rejoined the Belding Heminway Company after a two-year absence. His initial assignments involve systems management, distribution management and marketing/production liaison. Norm eventually plans to relocate to either Northern New Jersey or Connecticut from his present home in Philadelphia. . . . Professor **Elliot M. Cramer** of the University of North Carolina at Chapel Hill has been Acting Director of the Psychometric Laboratory since September 1. Elliot is still Associate Professor in the Department of Psychology. . . . In December, **Robert W. Temple** became Vice President-Consulting Services for Williams Brothers Co., heading a new office in Atlanta. Bob's main activities are in acquisitions, corporate planning and finance. . . . **Austin R. Baer** is currently managing a product planning and development program for Allied Products Corporation in Chicago. Austin has been a product design consultant for the past 13 years in New York, Raleigh and Miami. One of his recent projects for Allied involved the design of a new collapsible intermodal shipping container which features a patented extruded hinge which Austin designed prior to his joining the company.

Marc Gross writes that he is looking forward to the 15th reunion and brings us up-to-date by telling of Steven, born March 13, making three Grosses (only 141 more to go). Marc was able to take his two older children on a Western trip in August, and wife, Devra, on a combined business and pleasure trip in November that included Israel, Italy, France and England. . . . **Dean E. Bensley** was recently promoted to Plant Manager of the Waltham Plant of Raytheon's Equipment Division. . . . The November issue of *Datamation* included an article co-authored by **Donald B. Steig**, titled "File Management Systems: A Current Summary." Don is Manager of Management Sciences for Hoffman-LaRoche Inc. and teaches computer-related subjects at Rutgers University.

We hope to see some of you at Alumni Day. It's been 15 years since many of us have been on the campus and it is a very eye-opening experience to see things first-hand. Many of us are including Alumni Day to cap off the reunion. We hope that those of you who are unable to

attend the reunion will be able to join with us for part, if not all, of Alumni Day. —Secretaries: **Mrs. J. H. Venarde** (Dell Lanier), 16 South Trail, Wilmington, Del. 19803; **L. Dennis Shapiro**, Aerospace Research, Inc., 130 Lincoln St., Brighton, Mass. 02135

56

Good news comes from Spain, whence cometh one of our class questionnaires informing us that **Roberto Perez-Amador** is in Madrid working for Procospain. In the section "Highlights of Husband's Major Accomplishments," his wife and mother of two, Alicia, has responded, "Getting out of Cuba!!" Apparently Roberto's forte isn't cutting sugarcane. . . . In Jamestown, R.I., you can drop your little ones off at the Friendship Nursery School where they will receive M.I.T.-trained supervision by **Virginia Coburn Clarke**, owner and operator for the past ten years. . . . **James M. Evans** is busy with Consolidation Coal, working on their "Project Gasoline"—an effort to extract liquid fuel from coal.

Dick Jacobs, operating out of Chicago, reports that his travels for A. T. Kearney & Co. took him to Mexico last summer where he and Nancy were hosted by classmate **Francisco "Pancho" Elias**, production head at Cia. Fundidora, Mexico's largest independent steel producer. . . . Dr. **David Kelley** has resigned from the Lahey Clinic in Boston to enter private practice of medicine in the Plymouth-Duxbury, Mass. area.

Bill Northfield has left Analog Devices to found, and become president of, Computer Devices in Cambridge. The company manufactures equipment for data communication. . . . **John Paterson**, whom some may remember as **John Patierno**, is manager of the Aerodynamic and Propulsion Group at Northrup in California, and is father of four. . . . **John Pierce** left M.I.T. and I.B.M. to move to Cincinnati to become a principal and vice president in Management Decision Systems, a newly formed consulting firm in the management science operation research field.

Under items we thought we would never see, this month we are pleased to report the December 20 wedding of **Jack Rosenfeld** to Annelise Kjaer at Frederiksberg Town Hall near Copenhagen, Denmark. Annelise was the head physical therapist at Copenhagen Hospital. Jack continues to work at I.B.M.'s Watson Research Center in Yorktown Heights, N.Y.

Andrew Viterbi was promoted to Professor of Engineering and Applied Science at U.C.L.A. last July. In addition, he received the outstanding paper award for 1968 from the I.E.E.E. Information Theory Group. . . . **Bruce Wedlock** will resign from the Electrical Engineering Department at M.I.T. this June.—Cosecretaries: **Bruce B. Bredehoft**, 3 Knollwood Dr., Dover, Mass. 02030; **T. Guy Spencer, Jr.**, 73 Church St., Weston, Mass. 02193

57

I'm snowed in here and it's very cold. I wish some of you were here to join me for a drink in front of the fire. Now for the news. . . . **Donald Aucamp** writes that he is an assistant professor at St. Louis University in the Industrial Engineering Department and about halfway through his Ph.D. thesis at Washington University in the Department of Allied Mathematics and Computer Sciences. . . . **Terrence McMahon** is currently operating as an independent consultant (McMahon Technology Associates, New York) in the field of industrial computer applications including process control, laboratory automation, communications control, etc. He received his doctorate in chemical engineering from Yale in 1962. . . . A brief note from **Robert Hanson** reads: "Now President of Pioneer Data Sciences, Inc. producing computer software packages. Family up to 5." . . . And still more in the computer area. Late in 1968, **Willis Miller** formed a new corporation, Miller-Ellis Computer Systems, Inc., of which he is president. This corporation is in the computer hardware/software systems business, as related especially to time-shared systems.

Dominick Fortunato advises us that last year their second child, a son, was born in May. They were planning to make a five-week visit to the Philippines to visit Dominick's wife's family. . . . A letter from **Kenneth Kanrick** advises us that he has formed his own business. It is the procurement of large-scale packaging such as folding cartons and plastics through an extensive knowledge of the packaging field. . . . Having served Boy Scout councils in Middletown, N.Y. and Dover, N.J. as a district Scout executive, **John S. Spencer** has been promoted to the position of Assistant Director of Finance Services, Greater New York Councils, Boy Scouts of America.

Art Bergles has left M.I.T. to join Georgia Tech as Professor of Mechanical Engineering. He will be responsible for development of undergraduate laboratories, heat-transfer courses, and research in two-phase flow and boiling heat transfer.

A biographical note in the *U.S. Naval Institute Proceedings*, September 1969, gives the following news of **Karl Duff**: "A graduate of Massachusetts Institute of Technology in 1957, Lieutenant Commander Duff was commissioned through the OCS program and served in the U.S.S. *Brown* (DD-546) from 1958 to 1961. He then returned to M.I.T. for graduate studies, receiving his M.S. degree in Naval Architecture and Marine Engineering in 1964, and a Doctor of Science degree in Mechanical Engineering in 1966. From 1966 to 1968, he was Hydrofoil Project Officer for the construction of the PLAINVIEW (AGEH-1) and the TUCUMCARI (PGH-2). Since 1967, he has been in charge of the Hydrofoil Special Trials Unit at Bremerton, Washington." . . . **Merlin Lickhalter** was vice chairman of the 1969 M.I.T. Midwest Conference in

St. Louis and was also appointed to the Educational Council. . . . **Harry Duane** has been elected Director of the Norton Company. Harry was named group vice president earlier this year with responsibility for international operations. Harry is also a director of the National Foreign Trade Council. . . . Any plans to get up this way this summer?—**Frederick L. Morefield**, Secretary, Tiirasaarentie 17, Lauttasaari, Helsinki 20, Finland

59

Joe Goodell has been named Administration and Control Manager of Chase Brass and Copper Co.'s Waterbury Division. Joe has been with Chase since 1965 and resides with his wife Margaret and three daughters in Southbury, Conn.

Joel Lazar writes that he is now serving as a project engineer for Metal Improvement Co., Inc. in Jersey City, N.J. . . . A recent press release announced that **William Butcher** has been promoted to assistant manager of the Engineering Department at Suburban Propane Gas Corp. in Whippany, N.J. Bill also has a wife Margaret and three daughters and resides in Andover, N.J.

Congratulations are in order to **Leon Glicksman** who was awarded the Melville Medal by the ASME for the outstanding paper published in 1969. . . . To conclude the Course II section of our class notes, a recent clipping announced formation of a new company, HyComp Inc. in Maynard, Mass. with **Dick Gurski** as a principal and president. HyComp Inc. is an engineering and manufacturing firm specializing in thin-film microelectronics, analog function modules and analog systems. Prior to the incorporation of HyComp Inc., Dick was manager of systems design for Philbrick/Nexus Research, a division of Teledyne.

We learned from the Alumni Office that **Steve Parkoff** has left M. Loeb Corp. in Washington D.C. to join the staff of Revlon Inc., in Edison, N.J. . . . On a recent business trip to Atlanta, **Al Bufferd** ran into **Steve Spooner** who asked to be remembered to all his friends through the class notes. Steve is currently on the faculty in the Metallurgy Department at Georgia Tech. Al also passed along the news that **Paul Ekberg** was recently promoted to the position of Superintendent of the B.O.F. facility at Youngstown Sheet and Tube Co., East Chicago, Indiana. . . . **Jerry Schooler** dropped me a note to say that he had joined the International Life Insurance Co. Ltd. in London with responsibilities for planning. . . . An interesting letter was also received from **Bruce Hayworth** who writes that it's been a while since he last wrote to the class secretary and that quite a lot has happened in the interim. He finds it hard to believe that his two sons Mark and Brent are now 9 and 10 years old—since it seems like only yesterday that we left M.I.T. He continues ". . . I recently resigned my position as Vice President of Maxwell Laboratories Inc. which I co-

founded four years ago and is now a very successful company (over 200 employees) in the field of high voltage technology. I have started a new company, Capacitor Specialists, Inc. which, as the name indicates, builds custom engineered capacitors. I guess I just like the excitement of new ventures. This week I am leaving on a tour through the South Pacific with my family, both as a reward to them for the past four years and a bribe to them for the next period."

Ron Stone has recently joined my own entrepreneurial venture, Technical Forum Associates, Inc. as Vice President-Operations. Ron has contributed much already to the recent success of the Company with the first seminar after his joining the staff, a sell-out seminar on Industrialized Building Technology chaired by Professor A. G. H. Dietz. . . . I had a drink during the holidays with **Marty King**, an old Boston Latin School classmate of mine as well. Marty, after getting his degree in Course XVIII decided the Hippocratic Trail was for him and completed his M.D. studies at the University of Rochester. He is currently specializing in pathology at the Peter Bent Brigham Hospital and living with his wife and infant daughter in Jamaica Plain.

John Brackett, now Director of Graphic Systems for SofTech Inc., Waltham, presented a paper at the recent A.A.A.S. Meeting in Boston titled "Trends in Computer Graphics". . . . **Bob McAuliffe** writes that he was recently promoted to Project Administrator—Philadelphia area for Cabot, Cabot and Forbes Co. He informs me that his family, consisting of his wife Lydia and their two children Ingrid and Mark, are now living in Bala-Cynwyd, Pa.

Paul Silverman is currently President of the M.I.T. Club of Chicago and invites all our classmates living in and around the Windy City to join and participate in their interesting programs. Speaking of Chicago, we received notice that **Dean Andrus** recently presented a paper titled "An A.C. Electric Drive System Applied To A Military Tracked Vehicle" at a Society of Automotive Engineers meeting there.—**Arthur Collias**, Secretary, 61 Highland Rd., Brookline, Mass. 02146

60

Frank and Mary Tapparo have been in the Washington, D.C., area since June 1967. Frank says: "still in the army—a Major now. I've been with the defense communications planning group since June 1967, but will depart for Vietnam on 11 November (1969). Mary is an analyst with World Systems Labs and will stay in Washington. Our boys, David, 7, and Stephen, 6, are both in school, which was Mary's excuse for breaking the housewife habit. Sorry that I'll miss the 10th reunion." I guess that's a valid excuse for not coming to the reunion. . . . Speaking of the reunion, don't forget—June 12-14 at the Jug End in South Egremont, Mass. Convenient to

the Boston, Hartford, and New York areas.

Joe Goodman is a senior consultant for Peat, Marwick, Mitchell & Co., in Washington, D.C. Before going to Washington in 1967, he worked for Peat, Marwick, Livingston in New York. Joe was with the California Division of Highways in Los Angeles from 1961-1965, and with Traffic Research Corp. in New York 1965-66. Joe reports that he is "still single and searching (but enjoying it)." . . . **Dave Geisler** writes, "Our family was transferred to Wilmington, Del., from Martinsville, Va., in August, by duPont, where I am involved with the Spunbonded® Manufacturing Management in Textile Fibers Department. We are continuing our hobby of racing a Triumph in the SCCA Amateur series and had fairly good fortune this year; working for a better one next year."

Pegi and Bob Stengel had a daughter on March 18, 1969. Bob reports "although this member of the class of '90 has not chosen a major, she has a keen interest in geometry (Creative Playthings 101), a strong voice, and a propensity to ham it up when her picture is being taken." . . . **Ray Waldmann** has moved again, "this time to Brussels, but still with Arthur D. Little, Inc., for which I do management consulting, economic planning and, occasionally, some legal work. Will welcome contact with M.I.T. alumni in Belgium or in transit. Wife and daughter surviving uprooting."

George Koo has "been with Allied Chemical, plastics division, for the last six years, with some time off to complete my Sc.D. at Stevens Institute of Technology (awarded June '69). Present position: technical supervisor in R&D. Polymer materials are my bag. Family-wise, wife: May Jen (Bryn Mawr '60), children: Denise, Douglas and Alyssa. The last arrived on Moratorium Day 1969, protesting vigorously, naturally."

I've got a very nice letter from **Hans Sitarz**. Hans worked in aerospace for six years, first with Boeing in Seattle and then with Thiokol in Maryland and then in Huntsville, Ala. But, says Hans, "you may recall that the campus radio station and later WXHR-FM in Boston occupied a great deal of my spare time while in Cambridge. And, in spite of interesting assignments in the aerospace field, my love of broadcasting could not be shaken off. So, after six years I stopped fighting it, and joined it. Consequently, I have been in television news and public affairs for the past three years, currently as news director for WHNT-TV, the CBS affiliate in Huntsville. From a family standpoint, we are now seven . . . having been three when we left Cambridge. We have four daughters and one son, who must try to keep his head above water being surrounded evenly on both sides by sisters."

John Windle and Dick Koplow have recently formed Business Equities Corp., 84 State St., Boston; they specialize in mergers, acquisitions and private place-

ments (raising venture capital). . . .

Morris Salame is involved in high polymer research as a research specialist with Monsanto in the area of rigid, disposable packages for beverages and foods. He says, "I hope you noticed (news items in *Wall Street Journal*, etc.) our first breakthrough resulting from our almost 9-year research effort: a completely synthetic polymeric material (which can be burned as easily as paper) for packaging soft drinks. Next time you pick up a coke, it may not be in glass or metal." . . . **Marian and Larry Martin** have a son, Nicholas Charles, born on November 21, 1969. . . . **Al Shalleck** has been appointed assistant vice president, corporate planning, for Leasco Data Processing Equipment Corp.

Bill Blatchley has "re-entered M.I.T. after a 9-year absence to scrape some of the rust off my brain. I am still in the chemical engineering department and plan to specialize in air and water pollution control." Bill is living in Somerville.

James Long is employed as an electrical engineer at the Lawrence Radiation Laboratory in Livermore, Calif. He is married and has two daughters, ages 3 and 1. . . . **Sue Schur** is listed in the new edition of *Who's Who of American Women* and in *Foremost Women in Communications*. Sue had a painting selected for a recent juried exhibition of paintings by New England artists.

I've received a few complaints about the notes; the most specific is that it reads like my "diary." If you don't like the way the notes are being handled, write and tell me exactly what you don't like. Or, send your comments along to Gerry Hurst, 305 Beatty Road, Media, Pa. 19063. Elections will be held during the reunion, so send off your comments as soon as possible. We're particularly interested in suggestions for the nominating committee. These are the class notes so should reflect what the Class wants. See you at the reunion. In the meantime, send news to—**Linda G. Sprague**, Secretary, 10 Acorn St., Cambridge, Mass. 01239

61

Many moons have passed since the last in this series. I have been busily engaged in the writing of a thesis, and the thought of writing about how all you people got your degrees back in the summer of '63 was too depressing. Now the thing is in the hands of the Gods, namely three readers, and there is nothing more for me to do. I'm doing a post-doc at Brandeis so the address remains the same (although the drive is a little longer).

Another long-time student is **Bob Katz** who wrote: "Briefly, I finally have received my Ph.D. in materials science from Course III (this also entailed spending 11 out of the past 12 years at the Institute full or part time, which, while no record, must approach one). My wife,

daughter and I moved into our new house in Natick this past July and I am still at the Watertown arsenal which is now the army materials and mechanics research center and I am currently a research ceramics engineer." . . . **Ken Lembach** chose the post-doctoral route at M.I.T. until last August and then moved on to become an Associate Professor of Biochemistry at Vanderbilt's School of Medicine. . . . Meanwhile across the river **Martin Falxa** was doing his post doc-ing at the Harvard Med School working with tissue culture and protein chemistry. Now he is back over on the Cambridge side at Kendall's Theodore Clark Lab. His wife, Marion, is working part time at the Bock Travel Service in Boston. Martin reports that **Hugh Willis** and Jim Coggins, '62, work for A.D. Little and that **Dick Naylor** is now an Assistant Professor of Geology at M.I.T. studying moonrocks.

Don Greenlee wrote that he is a MITRE Corp. Fellow doing work towards a doctorate in the Industrial and Systems Engineering Department of the University of Florida. Before becoming hooked up with MITRE he once worked for the Johns Hopkins Applied Physics Lab and for G.E. . . . **Bill Dyer** got an M.P.H. from the Harvard School of Public Health last June. This constituted the first year of a three-year residency program with the Air Force. The remaining two years will be at the USAF School of Aerospace Medicine at Brooks AFB in Texas.

Social Notes. (The Population Bomb Keeps Ticking Away)

George Harrison's wife Karen, was expecting a baby boy in February. . . . Last June 29 **Al Brennecke** became the father of twin boys. Mazeltov! Names: Phillip and Andrew. Al writes that: "the Belgian way of birth is as different from the American as the Belgian way of life. Both boys are growing at a rapid rate and have healthy lungs. The twins plus our two-year-old, Eric, give us a lacrosse midfield. Anyone want to try for a basketball team? (Not I!)." . . . **Gerald Staack** produced a Brian Robertson Staack January 4, 1969 (11 pounds).

Charles Arcand had a son, Alan Patric, last September. Last January Charles started working at Mohasco Industries as a research chemist working mainly on textile finishing treatments. Charlie is also involved in an M.B.A. program, part time, at the S.U.N.Y. in Albany.

Jet Set

Steve Salomon is in Siberia at Akademgorodok "Science City" doing research. Steve got his Ph.D. in physics at Purdue and then went east. . . . LCDR **William Broughton** is in Ottawa as a deputy project systems engineer on the DDH280 Class Destroyer project. . . . **Roberto Canal** writes that he is "going to Bucaramanga, Columbia as works manager of Forjas de Columbia, a forging company on the first of the year. M.I.T.ers in Columbia are welcome to see us." The Canals now have three kids, Kenneth

(11), Robert (9) and Milena (7). . . . Major **Pete Bankson** is back in Vietnam serving a second tour after a year's stay in Hanover, N.H. on the Dartmouth R.O.T.C. Staff. While at Dartmouth he says that his major contributions to the ivied walls were the construction of a potters wheel and a 15 cubic foot gas kiln, service as a church elder and target for anti-ROTC students. . . . Last December Captain **Roger Whitman** finished an 18-month tour in Vietnam as an Assistant Brigade Supply Officer for the 3rd Brigade, 82nd Airborne. On the way home he stopped off in Japan and India getting back to California in January. . . . **Al Crisi** says he is "enjoying the wonderful Colorado scenery."

Ken Scott was elected president of the Financial Publishing Co. of Boston about a year and a half ago. This firm, founded in 1896, employs about 100 people and provides professional products and services to bankers, attorneys, accountants and so on. . . . **Donald Easson** was promoted to manager of scientific computer services of which the current emphasis is in biomedical research. While Don's two children David (8) and Kim (5) are in school, wife, Gin, teaches nursery school and ice skating. . . . Speaking of promotions, (note how neatly I slide from person to person) **Jerome York** was promoted to advanced pre program business planning manager at Ford where he has been working since 1966 when he received an M.B.A. from the University of Michigan.

Speaking again of promotions (neat, huh?), in March 1969, **Glenn Ogletree** was promoted to director of the M.I.T. Apollo Division 23N (Radiation Sensor Systems). . . . And speaking of more promotions, **John Reed** is now a senior vice president of the First National City Bank of New York. This was no small accomplishment since this makes John the youngest senior vice president in the Bank's history. . . . **Joseph Gagan** is also associated with First National City Bank as a vice president of a leasing company owned by a holding company that also seems to control the Bank. Joe's company is called Citicorp Leasing Intn'l and is based in London and seems to be involved in computer leasing.

Robert Saba has moved from one part of U.S. Steel to another: from U.S.S. Chemicals to U.S.S. Engineers and Consultants, Inc. Now you should call him: Director-Technical Sales.

John Castle bid adieu to Proctor and Gamble last October and went over to M/K Systems, Inc. of Marblehead, Mass. They are consultants in reprography (whatever that is) and paper technology. He closes his card with the cryptic remark: "I'm glad to be back in the land of the living." **Don Marquis** is a sales representative in the Weyerhaeuser Technical Papers Group. Since Weyerhaeuser is getting involved in a new line of electrical insulating papers this means new opportunities and responsibilities for him.

Bill Leffler writes: "Next summer my family and I transfer to Houston, Texas with the rest of the Shell Chemical Co. (some 2,000 families are involved in the move). Imagine me, a 'native New Yawkka' for 29 years, wearing a stetson and cow boots!"

Teachers

And speaking of promotions **John Hovorka** (Sc.D.'61) is now a full Professor of Physics and chairman of the Division of Science and Mathematics at Curry College in Milton, Mass. If that were not enough, he is also Senior Research Associate in the Aeronautics and Astronautics Department of M.I.T. Whew!

Another Sc.D.'61 who made good is **Harold Smith** who is now also a full Professor of Electrical Engineering at the University of Toronto. He is also chairman of the Control Science and Engineering Program. . . . **Dewey Ryu** is teaching part time in the Chem Engineering Department at Rutgers and also holds down a full time job at the Squibb Institute for Medical Research. This, says he, keeps him busy (and out of trouble). . . . **Bill Watson** is also teaching. He is with I.B.M. teaching teleprocessing at the New York Field Systems Center.

Support your Local Classmate

And speaking of promotions, I would like to keep promoting you guys who are starting your own businesses. **Peter Hurwitz** writes: "I am attempting to start my own business. The name of the company is Chem-Netics, Inc. located in Norwood, Mass. We are essentially a service organization with interests in the electrodeposition of aluminum onto various metal substrates. Of interest also are other unusual electroless and electroplating applications not extensively performed by other companies in the area." —**Andrew Braun**, Secretary, 131 Freeman St., Brookline, Mass. 02146

62

Application of a Modified Fast Fourier Transform to Calculate Human Operator Describing Functions, written by **Richard S. Shirley**, Electronics Research Center, Cambridge, Mass., may be ordered by N69-21119. . . . Air Force Captain **Glenn A. Buckles** recently graduated from the Air University's Squadron Officer School at Maxwell AFB, Ala., and is being reassigned to the Pentagon, Washington, D.C., as a mathematician. He is joined by his wife, Pamela.

An article from the Dartmouth Alumni magazine dated December, 1969 reads as follows: "Another of the last of the dying breed is **Allen Hill**, who is due to take the aisle trip in January with Johanna Bartelenk of Concord, N.H. Following his Dartmouth tenure, Al made degree stops at M.I.T. and Penn, and now is an active architect in Boston. The bride-to-be polishes up the youngsters in the public school system in Stoneham, Mass." . . . **Raymond Wenig** writes, "Over the past year I have been

busy working as vice president of Operations for Managematics, Inc., a management sciences consulting firm in New York City. Most of our work is in the area of professional educational presentations and the implementation of computerized simulation models for decision analysis. On the home front, our second daughter, Cheryl Ruth, was born on October 9. We also acquired a motor home and have been camping throughout the East Coast on every available weekend. Other free time is devoted to showing dogs (Norwegian Elkhounds) and authoring a book."

George G. Mickey Haney finished his Ph.D. program at U.S.C. and is now working for TRW Systems in Redondo Beach, Calif. He and his wife welcomed their first child in September of 1969: a girl named Deanna Lynn. . . . **Clarence W. Wolf, Jr.** and his wife Nancy also have a baby girl, Stefanie Lynn, born November 24, 1969, and are living near Moorestown, N.J., where Clarence is working as a sales engineer for Union Carbide-Linde Molecular Sieves.

Jeremy E. Alperin, M.D. writes, "After graduating, I went to the University of Vermont Medical school, graduating in 1966, then had a one-year rotating internship in Rochester, N.Y., two years in the Navy (one on Guam and one in Philadelphia) and now am back in Rochester for a year of surgical residency. Starting in July, 1970, I will be in Cleveland for an ENT residency."

Adolfo Lau brings us up to date: "I opened my own architectural office since I returned from the U.S. In March, 1969, I entered and won a competition to plan and design a new mining community for the International Nickel Company in the northeastern part of the country. I also started to teach a course in design at the Facultad de Arquitectura of the University of San Carlos." . . . **Niel K. Weatherbie** is being transferred to Wildwood Air Force Station, Alaska, in May, 1970, to assume duties as officer in charge, Wildwood Autodin Switching Center. He will attend eight weeks training on the overseas autodin system at Fort Monmouth, N.J., prior to the assignment.

Donald E. Nelson writes that he is still employed by Union Carbide Corp., Carbon Products Division which he joined following graduation. He is currently a supervisor in the accounting department. The Fostoria, Ohio plant, his present location, manufactures carbon articles from electrodes for batteries to the space age material, thornel graphite yarn. He writes that his wife, Barbara, and he take great pleasure in watching their 14-month-old daughter Sherry grow up.

Eugene F. Finkin writes "I've left Fairbanks Norge Power Systems Division of Colt Industries, in Wisconsin, where I was chief tribologist, to join MTI (an R&D firm) near Albany, New York. . . .

James E. Beetem brings us up to date with the news that he received an M.B.A.,

from Stanford, 1969, and is now manager of sheet metal production control, Hewlett-Packard, Palo Alto, Calif.

David W. Ellis currently is serving as the acting academic vice president, University of New Hampshire, September 1, 1969 to February 1, 1970.

Urban designer **Marvin J. Richman** has joined the staff of Urban Investment and Development Co. as director of special projects, where he will explore innovations in shopping center design, development and operation for U.I.D.C. Prior to joining U.I.D.C., Marv was senior associate of a New York architecture and planning firm, where he directed planning for the Bronx Model Cities Program. He also worked in New York City on the Lower Manhattan Plan, a new community to house 100,000 people, and on a higher education center, University City, and has been involved in planning a new town near Lagos, Nigeria, and the development of Baltimore's Central Business District. In addition to his degree in architecture from M.I.T., he obtained a master's degree in city planning from New York University, has studied architecture in Chile on a State Department fellowship, and pursued advanced work in administration, urban studies and computer sciences at N.Y.U.

Gerald P. Spielman writes, "In June, 1968 I was married to my wife Marjorie (Droker) formerly of Malden, Mass. Presently living in Brookline, Mass., I am employed by Honeywell, Computer Control Division in Framingham." . . . After completing 25½ years of active duty in the U.S. Air Force, **Frank M. McMullen** retired from active duty on January 1, 1969 and went to work for Ling-Tempco-Vought (L.T.V.) Aerospace Corp. as an Applied Research & Development Project Engineer, and now resides at 2453 Lakeview Circle, Arlington, Texas 76010. . . . **Modesto A. Maidique** writes that he finished his Ph.D. in solid state electronics at M.I.T. in September and during the same month co-founded NOVA Devices, Inc., Woburn, Mass., with Doug Sullivan ('55). They will be manufacturing custom hybrid circuits and providing a computer automated volume testing service for microcircuits, particularly linears.

I have recently accepted the position of manager, real estate development, for Simpson Timber Company, a privately held firm based in Seattle with holdings in excess of 500,000 acres in California, Oregon and Washington. I plan to analyze these properties for potential recreational development and also to seek real estate ventures on non-company owned land.—**Gerald L. Katell**, Secretary, 13751 S.E. 20th Street, Bellevue, Wash. 98004

64

Classmates' continued contributions to the Alumni Fund have provided most of the notes below, so please keep it up!

Len Buckle and his wife Suzann head a 9-member team working on a master plan of development for the town of Northboro, Mass. Len and Suzann are both graduate students in the M.I.T. Department of City and Regional Planning. . . . **Donald Cameron** is working for I.B.M. as a marketing representative, with Lockheed Missiles & Space Co. as his principal client. . . . **John Clarke** has joined the staff of the Los Alamos Scientific Laboratory to work in the theoretical division. He received his Ph.D. in physics from Cornell, and is a member of the American Physical Society. He and his wife Janet are the parents of two sons.

Babara Cohen is in the advertising business, and devotes her talents in this area to the M.I.T. Alumni Center of New York by producing its newsletter, participating in planning, etc. Barbara also notes that her hair is now down to her waist, thus compensating in large measure for the number of balding heads that the reunion survey uncovered. . . . **Robert Colvin** is now an M.D. and a resident in pathology. The army beckons this July, which will involve himself, one wife, two cats, and two bicycles.

Jeanne Fertel received her Ph.D. in physics from M.I.T. last September, and at last report was seeking work in the face of a cutback of federal funds for research. . . . **Doug Fleckner** became the father of his first child, a boy, on September 1, 1969. . . . **James Flink** will finish his Ph.D. in food science at M.I.T. this year. He will then teach at the Technical University of Denmark for a year. . . . **Eric Greenwell** is now married and has a son, races a Formula Vee with a VW engine, and is the owner of a camper and pickup truck for skiing.

James Giffin, our Class Agent, has been elected assistant cashier in the commercial banking department of the First National Bank of Chicago. He and his wife Jacqueline live in Evanston.

George Harlem and his wife Rosina had their first child in January of 1969. George has left Itek Corp. to join Infoton, Inc., a new computer peripheral company in Burlington. . . . **James Harrill** is a major in the air force and a flight instructor at Laughlin AFB, Texas.

Bruce Hopkins has returned to the academic life as he works on his M.B.A. at Tuck School in Dartmouth. . . . **Talbot Hopper** is an instructor at I.B.M., teaching new employees systems programming. . . . **Clifford Laurence** is a Ph.D. candidate at Rice University in the Electrical Engineering Department. He is engaged in research in the field of non-linear optics.

John MacIntyre is a captain in the army, stationed at the Army Material Command as an operations research officer. . . . **Paul Newell** is the director of the biomedical engineering program and Professor of Mechanical Engineering at Texas A & M, and is a visiting Professor of Bio-

medical Engineering at Baylor College of Medicine. . . . **Ira Prensky** is working for E. G. & G. in Bedford, Mass. . . . **Charles Therrien** is employed by Analytic, Inc. of Burlington, after receiving his Ph.D. from M.I.T. last June. . . . **Jeremi Wesolowski** has completed one year as general manager of the Uruguayan branch of Squibb International.

Meanwhile, from the clippings and notes forwarded by the Alumni Office, we find that **Barry Blesser** is now an Assistant Professor at M.I.T. after receiving his Ph.D. there in electrical engineering. . . . **James Chang** has begun a residency in radiology (he doesn't state where) after marrying the former Victoria May Sun (Wellesley '68). . . . While we are still awaiting an astronaut who received his S.B. in '64, we do have three who received advanced degrees from M.I.T. in '64. These are **Philip Chapman** (M.S.'64), **Charles Duke** (M.S.'64), and **Edgar Mitchell** (Ph.D.'64).

Henry Corcoran has opened a distributorship for gyromatic stabilizers for cars. This is an auto safety product for All State's Safety Control of Dallas.

Bruce Crocker is a systems analyst with Standard Oil of California. He and his wife Suzie live in San Francisco and continue to enjoy the West Coast. . . . **Keith Doty** authored an article on circuit theory in the May, 1969 issue of *IEEE Transactions*. He is on the faculty at the University of Florida. . . . **Gabriel Enyedy** is a market representative for Tymshare, Inc. of Palo Alto. He and his wife Terri have two young boys—Christian and Noel.

That's the news for this month. Write and become a Class Hero.—**Ron Gilman**, Secretary, 5209 Peg Lane, Memphis, Tenn. 3817

65

Art Bushkin is working for Lockheed near San Francisco. . . . **Marc Steglitz** is a management science officer at Bankers Trust Company in New York City.

Mark Medress is now a research scientist at Univac in St. Paul after receiving his Ph.D. in electrical engineering from M.I.T. last September. . . . **John Torres** has been promoted to special projects test director in Link-Singer's military test engineering department. . . . **Dick Armstrong** was ordained an Episcopal minister last June and is currently serving a Framingham parish. The Armstrongs had their first child last January.

Jeff Karas has been appointed chairman of the simulation sub-committee for the Association of Users of the GE 600 computer.

Sherry and **Frank DeRemer** are thoroughly enjoying northern California. Frank is an Assistant Professor of Computer Science at the University of California at Santa Cruz, while Sherry is completing a Ph.D. in biology at Stanford.

Roy Wyttlenbach is working on a Ph.D. in philosophy at the University of Hawaii. . . . **Howie Ellis** is finishing up his doctorate at Harvard Business School and is planning on establishing his own consulting company in the New York City area. . . . **Steve Dangel** is completing his Sc.D. in mechanical engineering at M.I.T. while working as chief engineer for Lawson-Hemphill Company. . . . **Francis Gerstle** is completing his Ph.D. work in mechanical engineering at Duke and is teaching a material science lab under former M.I.T. Professor George Pearsall.

There have been a number of degrees conferred recently. **George Schreiber** sent a holiday note that he received his M.S. in environmental health from the Harvard School of Public Health and is now working on a Ph.D. at Johns Hopkins in the area of cardiovascular and respiratory physiology. He and three other M.I.T. grads have formed Environmental Sciences Associates, a Boston-based consulting company. . . . **Dave Crawford** received his M.B.A. from Northwestern and is now living in Racine, working in the Controller's Department at J. I. Case.

Will Welch received his Ph.D. in chemistry from Rice University last May and is currently doing advanced research at Berkeley.

Neil Lupton finished his Ph.D. work in chemistry at Yale and is now on active duty at the Rocket Propulsion Lab at Edwards AFB, Calif. . . . Captain **Tom Perrone** is serving as a weather officer at DaNang AFB. . . . **Ed Hoffer** is completing his internship in internal medicine at Massachusetts General Hospital. Next year he will be developing computer applications in clinical medicine. . . . **Jim MacMillan** is now doing post doctoral training in surgery at the University of Arizona. . . . **David Cook** and **Mike Long** are in internship at the University of Colorado's Medical Center. Dave is spending most of his weekends on the nearby ski slopes and is planning on going on to the National Cancer Institute after completing his residency. Mike will go on to Mass General Hospital. **Chuck Seniawski** will marry Miss Susan Searles this coming June. Susan is a University of Montana graduate from Great Falls, Montana. . . . **Norm Kaderlan** married the former Miss Alice Youngerman in Tucson this past December. Norm is completing his Ph.D. work in arts administration while Alice is studying for an M.A.T. in French. . . . Sharon and **David Rubin** report the birth of a son, Ari Michael, last October.—**James Wolf**, Brigham Road, Gates Mills, Ohio, 44040

66

This column is being written in the newly remodeled Engineering Library at M.I.T. I have come to the States for a few weeks to do some job recruiting and lecturing on our Oxford biomedical group activities. Since returning to

Boston I've bumped into or spoken to **Marv Sirbu**, **David Mundel** and **Jack Elder**. Each is still slugging away for his Ph.D. at M.I.T. Marv says that about half of his time is devoted to the Commission on M.I.T. Education. David is off for a week's holiday in St. Croix, Virgin Islands, and also told me that **Arlee Reno** too is at the Institute in the City Planning program.

David Vanderscoff and **Mark Glickstein** dropped notes expressing their gratitude at the reappearance of our Class's column. Dave even managed a pun at my "new(s) job." . . . Sandy and **George Berbeco** have moved to a home in Chestnut Hill. He's "doing real well, except for grass cutting and snow shoveling." . . . **Michael Potash** has returned to Boston! . . . **Howard Smith** is at Berkeley, doing graduate work in infrared astrophysics. . . . **Claudio Bertoli** joined Climax Molybdenum Co., a European research and development group.

Art Boyars began an M.S. program in electrical engineering at Wisconsin under the sponsorship of N.O.L. He'll be there until June. . . . **Jonathan Hopkins** "plods along" as a student at Cornell University Medical College, Class of 1972. . . . **Damian Kulash** hopes to finish his civil engineering Ph.D. at M.I.T. in June. His thesis is on bus routing and scheduling.

Terry Walzman was coauthor of "Bipolar Transmission with Zero Extraction" which appeared in the April 1969, *IEEE Transactions on Communications Technology*. . . . **Gordon Olson** is now with McDonnell-Douglas after a spell with Cornell Aeronautical Labs. . . . **Bob Munger** married Joanna Haskell in December, and they now live in Cleveland.

Rafael Camerini-Otero is still studying for his M.S. and Ph.D. in molecular biophysics at New York University School of Medicine. In July he married Carol Thorne Sheppard (Barnard '66) who is graduating as an M.D. this summer from the same school. . . . **Eugene Soltero** is currently manager of economics and planning for Texas International Petroleum Co. in Oklahoma City. In August he married Elizabeth Anne Richards of Penfield, N.Y. They enjoyed a European honeymoon which included Yugoslavia and Portugal. . . . **Mark Yogman** works in Esso's Mathematics and Systems Training Division, giving courses in operations research and computers to company analysts and middle managers from the U.S., Latin America, Europe and the Far East. (That doesn't leave too many areas not covered!)

Congratulations go to **Ken Browning** and **Stu Shapiro** for receiving Certificates of Appreciation from the M.I.T. Alumni Association for their outstanding efforts on behalf of the successful 1969 Alumni Fund. . . . **Nicholas Negroponte**, now an Assistant Professor of Architecture at the Tute, is helping to build the Architecture Machine, a computer system which will hopefully become a fully automatic architect itself and not just a design tool. He suggests that in another dozen years,

the Architecture Machine could be enrolled as a student. . . . **Wayne Baxter** writes: "Turnaround being fair play, I'm now supporting my wife Eileen while she attends a Ph.D. program in English literature at Rice. **Joel Talley** and I, having spent six years on the Charles, have finally started to sail. We've been crewing on losing ensigns this summer and fall. Rugby has come to Texas in full force; our goal is to put on an exhibition in the Astrodome during the half of an Oilers' game." . . . Janine and **Roy Levitch**, Sc.D. '66, have been living in Texas for three years since leaving Cambridge. Roy works for Shell's Houston Research Laboratory as a supervisor of the Hydro-processes Group. . . . **Chuck Holdaway** works for Astrodata of Anaheim, Calif., where he's been since graduation. He is presently on temporary assignment at R.C.A. Global Communications in New York City where he is also attending N.Y.U. grad school. He is "staying one small step ahead of the U.S. Army, having narrowly avoided induction last year." He has also returned to Boston "to reminisce and attend momentous events such as the L.S.C. free movie." Finally, he says he is still single.

Tony Pasquale joined IBM after finishing up his master's in September, 1968. The preceding month he married Dana Worsch of Redwood Falls, Minn. They now live in Washington, D.C. Tony is at IBM's Seismic Array Analysis Center, and Dana teaches the fourth grade. They may be heading back to school in a year or so for a Ph.D. in geophysics. . . . **Allen Post** worked for a while at the I-Labs before returning to M.I.T. to get S.M. and E.E. degrees in Course VI. At that time he lived with **Ed Fiala** and **Victor Nedzelinsky**. Ed is now with Bolt, Beranek and Newman in Cambridge. Allen has worked at MITRE Corp. since September, 1968, in the Communications Technique Department. In June he married Diane Adelsburg of Philadelphia and Emerson College ('71). . . . **Thomas Morrissey**, "After receiving an M.S. in electrical engineering in 1966 at M.I.T., received my Ph.D. in electrical engineering from the University of Notre Dame in October, 1968; married Patricia Ann Flaherty in November, 1968; completing military obligation as captain in the U.S. Army (from November 1968, through November 1970) at Aberdeen Proving Ground, Md.; and became father of Michael Patrick on October 14, 1969."

Darryl Sperber "has finally worked his way out to the West Coast. After two years with John Hancock Life Insurance in Boston while he earned his M.S. in actuarial science from Northeastern University, and then one and one half years with IBM's Insurance Industry Development Group in Chicago, he has joined up with Cybertek Computer Products, Inc., a brand new Los Angeles based software firm, of which he is a part owner, specializing in insurance applications."

John Golden writes, "I am married to the former Carolyn Pachessa (Mount Ida '64).

We have two daughters, Lisa, three and a half, and Jennifer, one and a half years, with another (a son I hope) due April 10 of this year. We now make our home in Needham, Mass. I have enclosed a prospectus of the company a group of us started last year to give you an idea of what I have been doing. We started Quantum Computing Corp. (another high technology company-computer manufacturing) early last year. It has been quite an experience up to now and this public offering of our common stock is no exception."

I'm very happy to see the response of the Class, including more personal letters in addition to the notes on the Alumni Fund mailers. Start thinking about our reunion next year and let me know if you have any ideas. Cheers.—**Terry J. Vander Werff**, 24 Horwood Close, Oxford OX3-7RF, England.

67

Since the weather this month (February) in Morocco has been surprisingly beautiful I have had the opportunity to play basketball and other sports almost everyday. Meanwhile my parents write it's thirty degrees below at home in Grand Forks, North Dakota. Hmm. Why not join the Peace Corps?

David Benson recently pointed out a little error that I had made in an earlier column: "I read with interest in the October/November issue of *Technology Review* that my wife and I attended Alumni Day on June 16 last summer. This is very interesting—perhaps you would be so good as to introduce me to my wife. Seriously, though, what a way to cram a guy's style! I have consulted my lawyer, and you can expect to hear from me in the near future." Evidently David is currently single and working in Hawaii for BOAC as their district manager. I wonder whose wife he was with? . . . **David Espar** writes that he married Sheri Gillette in October, 1968, when they were both in the Master's program in film at Stanford. Dave received his M.A. last fall, and Sheri will receive hers this quarter. His thesis was a film that he and Sheri made for M.I.T.—"MIT: Progressions." It's now being used by M.I.T. for freshman orientation, publicity and high school recruiting. (Anyone wishing to borrow a copy for local M.I.T. gatherings should contact Public Relations at M.I.T., Room 5-105). Dave and Sheri are now involved in a Palo Alto film company, Variation Films, that they founded with three Stanford classmates. Anyone interested in having a film made might write Dave, c/o Stanford Communication Dept.

Larry Taggart writes: "Things have been hectic for the Taggarts. We are still living in Chicago but hope to move to the suburbs soon. I received my M.B.A. from the University of Chicago in June. During the summer I was on active duty for the army reserves at Ft. Ord, California. On December 24, my wife Margie gave

birth to our first child, a son, Stephen Robert. I'm still working in production management for Proctor & Gamble." . . . **Tom Compton** married the former Nancy Marie Radocchia on September 13, 1969. Tom is still plugging away at an S.M. at M.I.T. and hopes to be finished in June. . . . **John Ruth** is working at the USAF Academy as a consultant in the area of aircraft inertial systems analysis.

Although he majored in aeronautical engineering, **Dan Hester** is now teaching mathematics at a high school in Hiram, Maine. He writes that he sincerely enjoys his work and that he tries to be instrumental in recreational and educational programs for youth in his area. . . . **Joel Berk** is working for Union Carbide at Bound Brook, N.J. On May 23, 1970, he will marry Miss Nancy Lorber, a graduate of the University of Pennsylvania. . . . **Ronald Brown** is still working towards his Ph.D. in biochemistry at the University of Chicago. Last August he married the former Rhea Strauss from Lincolnwood, Ill. and the University of Illinois. . . . **Joel Shwimer** is an instructor at the Sloan School at M.I.T. while working on his Ph.D. thesis. On June 15, 1969, he married the former Miss Elaine Konterwitz of New York City and Brandeis University. Elaine is at Harvard working towards a Ph.D. in French. . . . **George Starkschall** is struggling valiantly on his research for his Ph.D. in chemical physics at Harvard. He is also a teaching Fellow in chemistry. During the summer George was a tutor in Harvard's Intensive Summer Studies program, a program to assist students from southern colleges in graduate school preparation. Most of these colleges are predominantly black.

Louis Schwartzkopf is still a grad student in physics at Berkeley. . . . **Marty Kohn** is in his second year at Harvard Medical School. . . . **Janet Allen** is still at Berkeley working for a Ph.D. in biophysics. . . . **C. J. Monego** has been appointed for the Secretary of the Army Research and Study Fellowship. The study is being conducted at the University of Manchester.

On September 27 **Edward Jakush** married the former Miss Judith Doyle of Cincinnati. They have a house in Atlanta, although Ed doesn't see it too often since he has to cover Florida, Georgia, Alabama, and Tennessee as a technical sales representative with Rohm & Haas. The work is fascinating, evidently a sort of salaried bull session. He is playing ball for the Atlanta Rugby Football Club, along with two other M.I.T. men, and he is also playing ice hockey with an amateur club whose formation was engineered by Allen Clark, M.I.T. '63. . . . **Sydney Martin** is working for Analytics, Inc. in Philadelphia. . . . **Richard Stein** received his M.S. last June and is looking for a good thesis topic to keep him off the streets for a few more years. His present game is low energy electron diffraction in scenic downtown Brooklyn.

Brian Krupp received an N.S.F. Traineeship last fall. . . . **Alan Gevins**

completed his M.A. thesis "An Integral Model of Consciousness" for California Institute of Asian Studies. He's now doing research on physiological and psychological effects of alternating fields at Langlen Porter Hospital. . . . **M. M. Yovanovich**, Sc.D., is Associate Professor of Mechanical Engineering at the University of Waterloo, Waterloo, Ontario. He also spent two years teaching and conducting research at the University of Poitiers, France.

Ronald Lipsman, Ph.D., is associate professor in the Department of Mathematics at the University of Maryland, College Park.

Kevin Kinsella, who's teaching mathematics and doing research in Beirut, plans to study Russian this summer in the Soviet Union before spending the academic year 1970-71 in Sweden.

In March 1969, **Bill Weber** married the former Mary Posada of Medellin, Columbia, S.A. He's been transferred to the system analysis section at Philco where he's doing extensive work in analog computer simulation. Bill likes California as he can ride his motorcycle all year round. . . . **John Ebert**, while on a West Coast assignment last summer, visited **Al Gammon** and his wife Julie in Oxnard. While at Al's home he also ran into Stu Shapiro, '66. . . . **John Tolvonen** married the former Patricia Scarpitti last August. He's working on his Ph.D. in molecular biology at U.C.L.A. and his wife is teaching English at Orange Coast College. . . . Still single, **Jack Mumford** is working for Ford Motor Company as a transportation analyst. He's living in Ann Arbor and loving it.

Herbert Zeller is employed with the Architects Collaborative, Inc., in Cambridge. A honeymoon in Spain and Morocco followed his marriage to Melissa Houlihan, August 23, 1969. . . . **Henry Heines**, having received a master's in chemical engineering from the University of Illinois, is working on a Ph.D. He's trying also to avoid the draft by being a teaching assistant. . . . After attending Sloan School for a year, **Fred Goldman** worked one year at Decision Technology, Inc., Cambridge. He's now back at Sloan expecting to receive his S.M. in management in June.

After a one year post-doctoral at Cal Tech, **Chris Scholz** has been doing research at Lamont-Doherty Geological Observatory. He has been working on several projects, including the lunar project. . . . **Dave Sanders** has been made an operations manager for Hewlett-Packard's Cupertino Division. He's enjoying life very much in the San Francisco Bay area. . . . **Stephen Metz** expects to receive his graduate degree from M.I.T. in June. He will have to spend three years in the navy, but he doesn't yet know where. He and his wife Sandy have their first child, a son Jason, born June 1969.—**Jim Swanson**, Secretary, Services Provinciaux, Beni-Mellal, Morocco

68

Greetings again from scenic Cambridge. I'd like to start off this month with two administrative notes. First, let's try to get everyone's class affiliation settled by June. If you consider yourself in the Class of 1968, but did not receive a degree in June 1968, please write to either me or the Alumni Association and the matter will be corrected painlessly. Second, I would like to tell everyone what material we print and what we don't print. Information received on Alumni Fund envelopes ("Notes on my activities for my Class Secretary to appear in a future Technology Review") is printed unless you specifically state otherwise or it's too obscene. Information that Gail and I receive in personal correspondence is not printed unless it is stated that it may be published.

Stories which I hear around the Institute are printed if the source is reliable and if it is appropriate. Finally, we don't know how much money you give to the Alumni Fund because we only get half the envelope, empty.

Coed Connubiality

This month the only nuptial news concerns coeds. (What happened to all the single guys in the class?) **Alicia Compere** is now Mrs. Alicia Whitney and is living in Stanford, California. This information came from a change of address notice we got (fair game) as did a previous announcement about the former **Sue Weiss**. Sue now has supplied more details; the lucky guy is Alan Liebman and they were married in August 1969. Finally **Razel (Wittels) Kallberg's** sister, Jill Wittels, '70 has married Norm Punskey, '69. Both are still at M.I.T. and they're living in Eastgate. Razel is married to **Keith Kallberg**.

Dateline Vietnam

Weddings might be decreasing, but the number of classmates in Vietnam is on an upswing no matter what Washington says. **Sp/4 Lee Linthicum** writes, "After having studied Vietnamese for a year in El Paso, Texas by the grace of our dear military (at a cost to the tax payers rumored to approach \$20,000), I am presently working as an interpreter for a civil affairs platoon at Phuoc Vinh, about two hours by jeep from Saigon. A brief word of explanation: U.S. Army Civil Affairs vaguely resembles an armed Peace Corps, if sense can be made from that antithesis. Projects range from agricultural assistance (e.g. inoculating livestock), to aid for refugees, to conducting English classes at the local high school, although the usefulness of this last escapes me unless it is a foreboding of things to come in Vietnam."

Second Lieutenant **Joseph Fields** writes that he is in Vietnam with the 25th Infantry Division. . . . Lieutenant **Robert Cubert** reports that he is Weapons Platoon Commander, Third Battalion, 1st Marines (1st Marine Division) southwest of Danang.

Back on this side of the world, **Sp/4 Doug Wilson** writes that he "lucked out" in the army. He is now doing research on interior ballistics at Aberdeen Proving Ground, Maryland. . . . **Neil Cohen** was studying math at Princeton prior to being drafted. . . . Similarly, **John Barravechio** had been studying molecular biology at Berkeley but now finds himself at Ft. Sam Houston, Texas.

Mark Fidelman is at Ft. Carson, Colorado. . . . **Steve Reimers** reports that he is project officer for the navy's Experimental Diving Unit, having attended the U.S. Naval School of Diving and Salvage during the summer of 1969.

Paul Forbes is at Navy OCS in Newport, R.I. while Lieutenant **Robert Jacobus** is at the Air Defense School at Ft. Bliss, Texas. . . . **Thomas James** now precedes his names with the title Ensign, more details when they are available.

Karl Hella is currently in the Army and is studying the Saigon dialect of the Vietnamese language at the Defense Language Institute in Monterey, Calif. . . . Finally, Major **M.A. Bucciarelli** has returned from Southeast Asia and is assigned as Chief, Office of Engineering at the Boston Defense Contract Administration Services Region (DCASR). . . . Second Lieutenant **Howard Evans**, a navigator-bombardier, is assigned to the 15th Tactical Fighter Wing, a unit of the Tactical Air Command, at Mac Dill AFB, Fla. He was previously at Mather AFB, Calif.

Class Heroine

We recently received a long letter from **Ellen (Colmer) Domb** who said she's been enjoying the news in the column and would like to supply some of her own. She was married to Bill Domb (Amherst '68) two days after graduation (wasn't everybody) and spent the summer working for N.A.S.A. in Cambridge. In the fall they moved to Philadelphia where Bill has been teaching biology at the Chestnut Hill Academy. Last June, Ellen received an M.S. in physics from University of Pennsylvania and then spent the summer programming Monte Carlo simulations for high energy physics. Since high energy physics is the object of a big budget squeeze now, she decided to change fields; she's now at Temple University studying low temperature physics and hopes to do a thesis on transport phenomena in materials with dilute magnetic impurities. However, life has not been all work for the Dombs. Ellen reports that they enjoy scuba diving and have been to Gloucester, Mass., the Virgin Islands last summer, and hope to go to Key Largo this summer.

From far off Holland **Fred Heutink** writes that he is working there for Philips. Fred says that the atmosphere is relaxed and enjoyable and you get four weeks vacation! However, everything is not perfect; "I would recommend it to anybody who can stand the hefty tax bite and the gray climate." . . . Closer

to home, **Al Harger** is working for High Voltage Engineering.

Graduate School Stories

Are you worried about California sliding into the ocean? **Keith Kallberg** has written a report "Seismic Risk in Southern California" which is available from the Clearinghouse (CFSTI) as PB-186241. According to the abstract "preliminary contour maps covering the region are developed for the maximum site accelerations with 100 and 200 year return periods." . . . **Gilbert Shen** is a graduate student in physics at Berkeley. . . . **Richard Handler** writes that he and his wife participated in the November 15 Mobilization March in San Francisco and that it was the most impressive experience either had ever had. Although the news reports estimated an attendance of 100,000, Dick says this represents a dynamic equilibrium over a three-hour period, not the total participation. He reports meeting many friends from both Stanford Med and M.I.T. there. . . . In December **Mike Rabinowitz** received a Master's degree in planetary and space physics and has entered the Ph.D. program in geochemistry at U.C.L.A.

We have news this month from three future M.D.'s in the class. **Paul Gluck** is at N.Y.U. School of Medicine while **Arthur Klein** is nearby at State University of New York Downstate Medical Center and **Tessa Orellana** is closer to the Tute as a second-year student at Harvard Med. . . . **Chip Dancy** has been studying computer science in the M.I.T. Electrical Engineering Department and is now completing his thesis while working for Intercomp, Inc. in Cambridge. He escaped the draft last year as a teaching assistant but his draft board is after him now. . . . **Dave Seldin** narrowly avoided the draft by flunking a physical in December 1968 and is now 1-Y while he is working towards a Ph.D. in physics at the University of Colorado. . . . **Bill Mack** is a teaching assistant for Professor Rohsenow at M.I.T. . . . At Harvard we have **Andy Friedland** who is a first-year student in the Law School and **Burton Rothberg** who is a doctoral student at the B School specializing in mathematical decision theory. . . . **George Jones**, a second-year student at Harvard Business School, married the former Anne Schaffer and has two daughters, Heidi, six months, and Bonnie, two and a half years.

Dan Asimov reports from Berkeley that he has passed his doctoral exams and is now hoping to write a thesis. . . . **John Vitek** received a master's in materials sciences at Cal Tech and has returned to Boston with his wife Martha and is now in Course III working on a Ph.D. . . . **Russell Mersereau** is also at the 'tute working towards a doctorate in Course VI. . . . On the other side of the Atlantic, **Bruce Creager** has been awarded by the American-Scandinavian Foundation a one-year fellowship at the Danish Royal Academy of Fine Arts as a George C. Marshall Fellow. . . . **George Digioia** is a doctoral candidate at the University of New Hampshire in microbiology.

George and Toni report having an adorable daughter, Gina Antoinette, who is now two years old.

Nathan Curland is working for a Ph.D. in electrical engineering at the University of Minnesota. He says he's been married since October 31, 1968, but has supplied no more details. . . . **Kemal Nisancioglu** has received an M.S. and is studying for a doctorate in chemical engineering at Berkeley. . . . **Pete Pekarsky** is combining work with school. He's a consultant with Booz-Allen Applied Research in Bethesda, Md., and also expects to receive an M.A. in political science from George Washington University in June.

The Scientists and Engineers for Social and Political Action (S.E.S.P.A.), a Stanford area group, has written a "personal pledge for students, teachers, and professionals in science and engineering" which goes as follows: "I pledge that I will not participate in war research or weapons production. I further pledge to counsel my students and urge my colleagues to do the same." The group has produced a booklet giving several individuals' interpretation of this pledge and **Jeff Stokes** has contributed an essay. He considers the situation of a scientist doing basic research on a military project. While this is not "war research" in the strict sense, he concludes that the researcher should not sign the pledge unless he is prepared to advocate its principles. Jeff writes, "You must make it known that you oppose the militarization of society, university complicity, or whatever; make it known, at work and elsewhere that you favor such things as diversion of military funds into important domestic programs, declassification of research that the government claims is mainly domestic in benefit, aiding foreign countries with butter and not guns, repealing the draft and ending the Vietnam war." I would be glad to print more comments in the future concerning the role of the scientist and engineer in society and the social implications of technology.

That's all there is for this month. Please drop us a line and tell us what you're doing if you haven't recently. Finally we'll end on this bright note from **Theodore Applebaum**, "Life is a gas."—**Gail and Mike Marcus**, Secretaries, Eastgate Apt. 16A, 60 Wadsworth St., Cambridge, Mass. 02142

69

Since last month I have received letters from several of our classmates to share with you. I hope that more will be doing the same in the near future. After all, there must be something that's happened in your life in the last year which has not appeared in this column. Please keep me informed so that I can share your experiences with the rest of our classmates.

Tom Thomas writes that he has lost contact and would appreciate hearing from

his classmates so drop him a line at P.O. Box 354, Saquache, Colorado, 81149. He reports that his life as a VISTA volunteer in a town of 600 is rewarding, usually frustrating, and always interesting. His work includes adult education, community organization, Head Start, and recreation. In August he will be leaving VISTA to marry Miss Barbara Killian at which time they plan to set up shop at the University of Missouri in Columbia where Tom will attend law school.

Henry I. Miller has supplied me with information on several of our classmates. Henry is working towards his Ph.D. in biology at the University of California, San Diego, where **Jerry Goldstein** and **Mark Mitchell** are enrolled as medical students. Among other activities Henry has had the opportunity to work for a while at the Salk Institute where he encountered Course VII Professor Salvador Luria who is a non-resident fellow. Also of newsworthiness is the fact that Henry took time off in August to serve as best man at the wedding of **Lawrence G. Stern** and the former Miss Nancy Matsuoka who graduated from Boston University in 1969. They now reside in Rochester, N.Y., where Larry is enrolled in an M.D.-Ph.D. program at Rochester Medical School. . . . **Samuel Jacobs** is working for the Federal Systems Division of IBM in Owego, N.Y. as a circuit design engineer. Simultaneously, he is working towards his M.S. in electrical engineering from Syracuse University.

Christopher Brooks married the former Miss Barbara Lee of Norwalk, Conn., on August 2, 1969. Presently working for Hamilton Standard Division of United Aircraft Corp., he is now assigned to the Boeing Co. in Everett, Wash., supporting the 747 flight test program. . . . I have one other engagement to announce. **James A. Kirk** is planning an August wedding with Miss Joyce May. At present he is working towards his Ph.D. in the surface laboratory of the mechanical engineering department at M.I.T.

Russell T. Bock has been commissioned a second lieutenant in the U.S. Air Force upon graduation from Officer Training School at Lackland AFB, Texas. Russ has been assigned to Sheppard AFB, Texas, for training as a missile launch officer.

Among short notes I have received the following: **Richard W. Dorman** is completing his first year at Harvard Business School; **Joseph C. Willing**, a Marshall Scholar, is a graduate student in astrophysics at Trinity College, Cambridge, England; **Michael Talalay** has begun studies towards an M.A. in political science at York University, Toronto, Canada; and **Stephen L. Weinberg** reports that he is "alive and well in the Berkeley Physics Department."—**Richard J. Moen**, Secretary-Treasurer, 312 Shaw Hall, Cambridge, Mass. 02138

Loeb, Rhoades & Co. is a partnership of broad scope offering a wide range of services in the area of investment banking and securities investment. Such services include:

Security brokerage here and abroad for individual and institutional investors.

Investment research in depth.

Maintenance of markets in a wide variety of unlisted securities, both foreign and domestic.

Execution of large block transactions.

Investment management service for individuals and institutions.

Making of markets in corporate and tax-exempt bonds.

Corporate financing through public distribution or private placement of securities.

Initiation and negotiation of mergers and acquisitions.

Venture capital for young companies of promise.

 **LOEB, RHOADES & CO.**

42 WALL STREET, NEW YORK 10005
MEMBERS NEW YORK STOCK EXCHANGE AND OTHER PRINCIPAL EXCHANGES



THE "INTERMEDIATE" SYNTHESIZER



160 MHz for \$5900

Buying a frequency synthesizer has been something like buying a car. There's a confusion of models, options, and price ranges. Except — there has never been a so-called "intermediate"-model synthesizer. That's because price and performance ranges of synthesizers have tended to cluster just at both ends of the spectrum. The choice was between lower-cost, limited-frequency-range models and those with everything, including a sky-high price tag. So, the buying decision was one based on either trade-off or over-capability.

This is not true any longer! GR has filled the price-capability gap with the new 1165 Frequency Synthesizer. Frequency range is wide, 0.01 to 160 MHz in 100-Hz steps. The price is only \$5900, less than half the price it used to cost to get 160 MHz. If you can furnish your own frequency reference signal (5 or 10 MHz), you can get a model for only \$5300. In the \$5900 model, frequency accuracy is maintained either by an internal precision 10-MHz oscillator (1×10^{-9} per day) or by an external drive or lock source. Output is 0.1 to 1 V into 50 ohms. Both frequency and level can be externally programmed; the 1165 is ideal for applications requiring remotely-programmed local oscillators. Harmonics are typically down 30 dB (at maximum output into 50- Ω load); spurious, discrete non-harmonic signals are typically down 60 dB.

For complete information, write General Radio, West Concord, Mass. 01781; telephone (617) 369-4400. In Europe: Postfach 124, CH 8034, Zurich, Switzerland.

GENERAL RADIO

